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Governmental Approaches To Air Pollution Control

A Compendium And
Annotated Bibliography

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16. Abstracts - A study is presented consisting of a compilation of information to be used for evaluation of present programs and development of new approaches to air pollution control. The study begins with the description and analysis of federal legislation with particular reference to the Clean Air Act. Federal experience with voluntary compliance is reviewed. The experience with emission standards is reviewed and analyzed. A review is presented of various land use controls to improve the dispersion of pollution from stationary sources and to reduce exposure to pollutants. The role that private legal action may play in the control of pollution is reviewed. Information is presented on the concept of cost sharing and such measures as accelerated depreciation, investment tax-credits and tax exemptions. The use of economic incentives making it profitable for a firm to introduce measures for pollution control and, the possibilities of requiring polluters to pay a charge for which they are responsible are reviewed. The system for the control of air pollution in use in South Wales is described and analyzed. Finally, an assessment of the above approaches based upon the evaluation criteria which were developed in the course of the project is discussed.			
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LYLE C. FITCH, PRESIDENT

July 15, 1971

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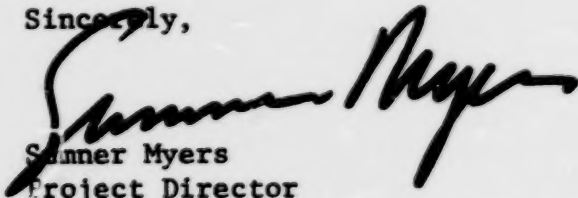
Dear Mr. Gerhardt:

I am pleased to transmit the attached report, Governmental Approaches to Air Pollution Control: A Compendium and Annotated Bibliography, by the Institute of Public Administration. This report is the companion volume to Governmental Approaches to Automobile Air Pollution Control. Together, these reports represent a comprehensive examination of governmental approaches to controlling both stationary source and mobile source air pollution. Their purpose is to provide background information and informed judgment on which to base future policy decisions.

Probably no policy problem is more interdisciplinary than pollution. Many kinds of knowledge are required to comprehend the problem, and many persons from differing disciplines have contributed to the present report. Coordinating the research for this report was the responsibility of Robert Witherspoon. The principal professional staff for the project included John Hoicka (economics), Terry Trumbull (law), and Donald Infeld (management science). Michael Keaton of our technical affiliate Teknekron, Inc. provided valuable insights on the "state-of-the-art" of air pollution monitoring and emission control technology. Finally, Lyle Fitch, President of the Institute, reviewed the entire report in detail and rendered substantial improvements, particularly to the concluding chapter.

I would also like to note the special assistance of the Office of Program Development staff and various other EPA officials. They were often the source of much fugitive information and were exceptionally helpful in structuring the organization of this report so as to enhance its usefulness, both within EPA and in other areas inside and out of government.

Sincerely,



Sumner Myers
Project Director

SM:bb -

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**GOVERNMENTAL APPROACHES
TO AIR POLLUTION CONTROL:**

**A Compendium and
Annotated Bibliography**

**This report was prepared by
Robert Witherspoon, Project
Coordinator, and John Hoicka,
Terry Trumbull, and Don Infeld
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INTRODUCTION

As a public policy issue, the problem of air pollution control is of relatively recent origin. Prior to World War II, efforts at control were extremely limited; a few large localities where the problem was most acute attempted to abate pollution using their police power and their authority to abate nuisances, but even these control efforts were concerned exclusively with smoke. It is only recently that the dangers of less obvious pollutants (e.g., organic and nonorganic vapors, airborne particles in the sub-micron size range) have begun to be understood. Government at all levels has been slow to recognize these new problems. The first permanent air pollution control legislation at the federal level was passed less than a decade ago, in 1963, and the majority of state and local control programs are still in embryonic form. It is against this background, and in these circumstances, that this report is offered.

As of mid-1970, the Institute of Public Administration was asked to undertake a study of governmental approaches to air pollution control. So much had happened during recent years that it was not easy even to frame the terms of reference of this study, and both the scope and direction of the report have been revised considerably, in consultation with the contracting agency, since the project began. For example, under the research design originally developed, the project was to concentrate on sulfur oxide pollution from stationary sources, with particular attention paid to the control problems of power plants and gray iron foundries. An integral

part of this research was to have been the identification and analysis of the associated technical considerations (e.g., monitoring requirements at the source, the feasibility of alternative control technologies). Each of these limitations was abandoned in the course of this project because it was felt that broader, more comprehensive research was required. The literature which had to be reviewed--even since the mid-1960's--was enormous.¹ Likewise, pollution control programs at all levels of government were evolving rapidly. And with the passage of the 1970 Clean Air Amendments, a basic re-evaluation of the federal legal framework for air pollution control was required.

Given a subject matter so large and diffuse, it was impossible to delve into many of the details of pollution control programs. In some cases, these details may be the deciding factors in determining the feasibility of an approach. For example, what kinds of monitoring equipment and professional personnel would be needed under an approach based on emission standards, and how would these differ from the requirements of an emission charges approach? Furthermore, lack of data precluded realistic comparisons in many cases, for example, as to the administrative problems raised by the various approaches. As a result, this report cannot pretend to provide the details of what particular pollution control agencies

1. Originally noted by members of the project staff for their own use, the list of publications consulted in the course of compiling this report expanded to almost 400 entries, and has been incorporated at the end of the Compendium in the form of an annotated bibliography.

and programs do. Many specifics of the subject have been touched only briefly; and throughout the report, the reader is referred to other works. What is offered is an examination of governmental approaches to air pollution control with a degree of breadth not previously attempted.

In this connection, it seems that the need for the present survey is compelling. Although a vast number of studies have already appeared all over the world on individual aspects of air pollution control, no attempt has been made to bring together the ideas and experience of relevance into a single document. What is more, there is a paucity of policy-oriented research. Hopefully, the information compiled in this compendium can serve to further the evaluation of present programs, as well as the development of new approaches to air pollution control.

The purpose of this research, as set forth by contractual agreement, is "to identify and evaluate alternative federal strategies to improve and develop inducements for control of air pollution by the private sector." Further definition of the scope of this study follows. First, "federal" has been taken quite broadly to include approaches generally also appropriate for other levels of government (e.g., local planning and zoning controls), or in the private sector (e.g., private legal action). The reason for this is that, while these approaches may not always be available or appropriate at the federal level, there is much that the Federal Government can do to encourage their use elsewhere. Legislation to facilitate

class action suits on environmental issues is one example; many others are discussed in the main body of this compendium.

The programs of state and local pollution control agencies are not examined extensively here. The available literature has been reviewed (see Section 3.2 of the Annotated Bibliography) and is often referred to throughout this compendium. However, a systematic study and evaluation of state and local enforcement efforts was not possible within this contract. Such a study is very much needed, particularly since most federal approaches to air pollution control must ultimately rely upon administration by state and local authorities. In our judgment, this should be a first priority area for further research.

Second, "inducements" are interpreted to encompass many approaches from carrots (e.g., direct grants, subsidies) to sticks (e.g., enforcement of emission standards, land use controls). It should be noted, moreover, that the subject of this study is the problem of controlling air pollution. Implicit in this approach is the assumption that, from the standpoint of pollution control, the most appropriate focus is the medium (air, water, food, etc.) through which a particular pollutant travels.¹

1. This assumption is based on the proposition that, both for enforcement procedures and for monitoring and control technologies, it is usually possible to work with only one medium at a time. The focus upon the medium for purposes of control, however, may cause many types of important problems to be overlooked. For example, the Food and Drug Administration has approved the use of polyvinyl chloride in food containers, even though this substance, when burned in incinerators, produces hydrochloric acid and thus a serious environmental hazard. Furthermore, the highly corrosive HCl significantly reduces the service life of incinerators. FDA, however, was concerned only about whether polyvinyl chloride would contaminate food and did not take into account

Third, our path will traverse only the private sector of the economy. It is recognized that significant air pollution occurs from public sector sources (e.g., municipal incinerators); but the terms of reference for this study did not include the public sector.¹

Nor is research and development discussed here as a separate approach, although it is a necessary complement to some approaches to air pollution control, without which new control techniques and technologies could not be developed and implemented. Actions can be taken by government to sponsor R&D itself and/or to encourage R&D in the private sector. For example, in the past year the U. S. Patent Office has moved to give priority to patents relating to pollution control, thus enabling such patents to be processed in approximately six months instead of the usual two years. Such actions should stimulate a speedier introduction of new methods of control. However, the appropriate role of R&D in air pollution

the potential air pollution threat. This suggests that, from the standpoint of standard setting (as distinguished from control), air, water, and other pollution should be treated together, since it is relatively immaterial for a person's health whether exposure to pollutants comes through air, water, food, drugs, soil or any other medium.

1. Although there are some important analogies between air and water pollution control, the private sector role is relatively more important in air pollution control. Unlike water, air cannot be centrally treated on a large scale; hence, control of air pollution must take place at each separate source before pollutants enter the air. This implies that, in air pollution control, much more of control expenditures must come from the private sector. The government's ability to induce pollution control in the private sector and to monitor the extent of compliance are the deciding factors. In contrast, the major role of government in water pollution control is to provide services (e.g., waste treatment plants); and the availability of public funds is frequently a major problem.

control is beyond the scope of this report,¹ and is not treated further except insofar as some approaches in and of themselves either encourage or discourage innovation.

A final limitation is that this report treats only the problems of controlling stationary source pollution. A companion volume to this report, Governmental Approaches to Automobile Air Pollution Control, has already been submitted. The subject of automobile air pollution was deemed so important and the scope of investigation so wide that it was decided to prepare a separate report rather than attempt to include the material in the present volume which is concerned primarily with pollution from stationary sources. These exclusions have been made so that the subject left, while very large, complex, and urgent, is nevertheless coherent and manageable.

Given the breadth of the study, and the volume of documentation that was digested in preparing it, it may be convenient to indicate here how it is organized. The study consists of ten chapters, beginning with the existing approaches to air pollution control--

1. An excellent example of such questions concerns the current disagreement between the Commerce Department and the Justice Department over the section of the Clean Air Act, as amended, which would require compulsory licensing of pollution control techniques and technologies in certain circumstances. The Commerce Department supports repeal of the provision on the grounds that compulsory licensing would remove the incentive for technological innovation, particularly among independent inventors. The Department of Justice, on the other hand, argues that the section as it stands now provides adequate safeguards for inventors. The compulsory licensing would occur only if the invention were necessary to enable compliance with pollution control statutes, if the patent was not reasonably available and if there were no reasonable alternatives to meet pollution control requirements.

present federal legislation, attempts at voluntary compliance, emission standards and land use controls--and then moves to newer approaches, notably cost sharing measures, economic incentives and emission charges, many of which have yet to be tried.

The pace and pattern of air pollution control have been determined increasingly by federal legislation. The report accordingly opens by describing and analyzing this legislation with particular reference to the 1970 Amendments to the Clean Air Act.

In the second chapter, federal experience with voluntary compliance is reviewed, and consideration is given to the extent to which government can encourage voluntary compliance to supplement the approaches described later in the Compendium.

Emission standards represent the prevailing approach in the United States. In Chapter 3 the experience with emission standards is reviewed and analyzed.

Chapter 4 reviews various land use controls to improve the dispersion of pollution from stationary sources and to reduce exposure to pollutants.

Chapter 5 reviews the role that private legal action may play in the control of pollution.

Chapter 6 deals with the concept of cost sharing and reviews measures such as accelerated depreciation, investment tax credits and tax exemptions.

The report then turns to the use of economic incentives that make it profitable for a firm to introduce measures for pollution control; the possibilities of requiring polluters to pay a charge for which they are responsible are reviewed in Chapter 8.

Chapter 9 describes and analyzes the system for the control of air pollution in use in New South Wales, which the authors of the report consider to be the most interesting experiment currently being undertaken outside the United States.

Chapter 10 contains an assessment of the above approaches based upon the evaluation criteria which were developed in the course of the project.

Like all attempts to analyze institutional behavior, the classification of approaches to air pollution control into these categories is an abstraction from the richness and complexity of reality.¹ In formulating definitions it has been necessary to make use of differing degrees of simplification. For example, it is recognized that enforcement of emission standards is ultimately dependent upon the prosecution of those who violate them and hence upon legal action. To cite another example: it may prove difficult in practice sometimes to draw the dividing line between economic incentives based upon surrogates for emissions and emission charges based upon emissions per se. Nevertheless, the distinctions between these approaches are deemed important (for reasons given in the body of the compendium below), and it is felt that this classification represents the "optimal" for purposes here, although another typology may prove more useful for other kinds of analysis.

1. In contrast to "approach," an air pollution control "program" as used in this compendium refers to the combination of measures actually used by a governmental agency. An existing air pollution control program could consist of emission standards, land use controls and economic incentives, each of which is analyzed as a separate approach in this compendium.

With the scope of research thus defined, the methodology adopted was as follows:

1. The identification and definition of the problem to be solved;
2. The clarification of objectives whose values are to be maximized subject to certain constraints;
3. The identification of broad approaches for achieving these objectives;
4. The development of criteria by which to evaluate the approaches; and
5. The application of these criteria.

It might be suggested that another step should be added to this methodology, namely the formulation of a course of action. But this was not our purpose. This report does not presume to recommend public policies; what is offered is a springboard for discussion and an aid to decision.

With respect to the second step--the clarification of objectives--the general goal of air pollution control, as set forth in federal legislation, is to achieve agreed-upon air quality standards. Where quality has deteriorated below such standards, the objective of control should be to attain air quality standards within a reasonable period of time.

This general goal, however, is not very helpful in choosing among various approaches to air pollution control. The major limitation of general goals is that they tend to provide little basis for evaluation of specific approaches, a process which necessitates the setting of priorities and the spending of money. Part of the problem concerns values. There may be widespread accord

about such goals as achieving air quality, improving housing, or reducing crime; but disagreement is bound to arise as soon as one moves to such specific objectives as traffic bans, public housing or preventive detention. Another part of the problem is that general goals are difficult to evaluate in and of themselves. The desirability of doing something depends on whether it can be done at all, how well, and at what cost. How much is it worth--in terms of higher electricity rates--to reduce fly ash and sulfur oxide emissions from power plants by 90, 95, or 99 percent? These questions must be answered if one is to decide rationally about how much of what kind of pollution should be reduced where.

In evaluating various approaches, some have assumed that most air pollution control objectives are self-explanatory and require little comment.¹ This is true in a very general sense. But in a more specific and useful sense--in which goals serve to guide action--there are many possible operational objectives, given the general goal of achieving an agreed upon air quality. Nor is the choice among them either immediately apparent or easy. One objective might be the reduction of total human exposure to air pollution. Another might be the reduction of average concentrations of air pollution. A third might be the reduction of total pollution emissions. Each objective could be related either to specific

1. Robert U. Ayres and Susan C. Simon (International Research & Technology Corporation), "Policy Alternatives for Environmental Management" (paper prepared for a Technology Assessment Seminar, George Washington University, March, 1971), p.11. (Mimeographed.)

pollutants (e.g., sulfur oxides) or to broad classes of pollutants (e.g., all major primary pollutants). Each pollution control objective, in turn, could be varied according to the area of application (e.g., a given air quality control region, the most polluted part of the city), the period of application (e.g., per day, per month, per year), or the extent of control desired (e.g., a reduction by 90, 95, or 99 percent of total pollution emissions, a limit of no more than 0.050 parts per million of pollution). Each of these objectives deserves a few brief observations.¹

The first objective--that of reducing total human exposure to air pollution--is generally advocated by "classical" economists. According to this view, the objective of air pollution control should be to minimize air pollution damages.² Thus, the damages to people from air pollution would be calculated for various amounts and kinds of pollutants at any given time.

1. The establishment of objectives is a crucial step in any pollution control program. Objectives not only reflect the priorities of the program, they also provide a benchmark against which to measure progress and to determine what actions are needed in the future. The specific objectives selected will depend upon the air pollution problem in each air quality control region. At this level, the factors contributing to air pollution vary widely and no uniformly optimum objective--or for that matter, a single best control strategy--is likely to be applicable to all air quality control regions.

2. The second half of this argument (i.e., that air pollution control programs should minimize the costs of control) is not considered at this time. Under this approach, the optimal allocation of air would require that pollutants be prevented from entering the atmosphere at levels which would inflict more marginal damage on receptors than the marginal cost of preventing the pollution.

However appealing this objective is in theory, the primary problems in practice are the shortage of data on damages and the lack of agreement on many of the conceptual problems involved.

The major information deficiencies are in the measurement of damages attributable to particular pollutants. . .and myriad conceptual and information problems inherent in the allocation to individual polluters of the share of the total damages for which they are 'responsible.' Perhaps most difficult of all is the theoretical problem of allocating damages to specific polluters when synergistic effects occur--that is, where the combination of two or more pollutants, such as sulfur oxide and hydrocarbons, causes greater damage than either pollutant could cause alone.¹

What is more, these problems are multiplied if, in addition to air pollution effects on people, the damages to crops, livestock, property and so on are considered. (Another problem--that of taking into account locational considerations--is discussed below.) These practical problems probably preclude the use of this objective for control programs at present although, as efforts to identify and measure air pollution damages continue, the damage function approach will certainly be used increasingly.²

A second control objective would be to reduce localized air pollution concentrations. An example would be setting an

1. George H. Hagevik, Decision-Making in Air Pollution Control (New York: Praeger, 1970), p. 65. There have been attempts to develop multiple indices to measure synergistic effects, but these are still in their infancy.

2. For a recent discussion of an approach to assessing these damages, see Paul H. Gerhardt, "How Much Is Air Pollution Costing?" Ohio's Health (November-December, 1970), pp. 5-13.

absolute ceiling on the amount of carbon monoxide concentrations between 8 a.m. and 6 p.m. in the central business district. If this were the control objective, then, plainly, public policy should be sensitive to considerations of pollution location and dispersion, not just to the magnitude of emissions. Some of the approaches considered in this compendium are addressed to locational considerations. For example, land use controls discussed in Chapter 4 represent an attempt to reduce stationary source emissions in urban areas (by encouraging plant location elsewhere), to improve the dispersion of pollutants (e.g., by increasing stack heights), and/or to alter urban land use and design so as to separate humans from high pollution concentrations and thereby increase the areas's assimilative capacity.

This objective, however, requires taking into account the susceptibility of pollutants to be readily transported and dispersed by the wind and of the geographical location of polluters in relation to meteorological data such as wind velocities and direction. Further, the differential diffusion characteristics of pollutants would have to be taken into account (e.g., gases are more readily dispersed than particulates). Diffusion modelling would have to be developed and applied. While information and techniques of this nature are clearly of ultimate utility in establishing air pollution control objectives, they are presently at a primitive stage of development in most control programs.

The third control objective--that of reducing total pollution emissions--is probably the most practical for control

programs at this time. It should be noted that this objective is the only one that does not require the explicit use of meteorological data and modelling and the consideration of locational variables. Since it is concerned only with the sources of pollutants and the quantity of pollutants emitted rather than with the effect of pollutants on air quality, on people, on agriculture, on materials or whatever, it has the virtue of simplicity. Admittedly, this objective is far from optimal since it neglects some important considerations. Nevertheless, all emission reductions will also tend to reduce the exposure of people to air pollutants, as well as reducing the concentration of air pollution in any given area. This objective, therefore, is at least of short term utility for stationary sources for pollution control.¹ It is expected, however, that, as more information and analytical techniques on air pollution damages and dispersion become available, it will prove possible for this operational objective to be increasingly refined.

With this brief discussion of air pollution objectives we turn to the main body of the compendium, in which the broad approaches for achieving these objectives are identified and discussed and then--in Chapter 10--are compared and evaluated.

1. Locational considerations are particularly significant in dealing with mobile source air pollution. See Institute of Public Administration, Governmental Approaches to Automobile Air Pollution Control, a report to the Air Pollution Control Office, Environmental Protection Agency, Washington, D.C., 1971, Chapter 4.

CHAPTER 1

FEDERAL LEGISLATIVE FRAMEWORK

The development of air pollution control measures in the United States has been determined increasingly by federal legislation. But it should be borne in mind that less than a decade ago there was no permanent air pollution control legislation in existence at the federal level. It is hardly surprising, therefore, that initial efforts to deal with large, complex and little understood problems were tentative in approach and often proved to be inadequate in practice. The legislative provisions for air pollution, for example, were taken from those for water pollution, even though there were a number of important differences between the two from the standpoint of control. Seen in this context, the most recent 1970 Amendments to the Clean Air Act represent remarkable progress in a very short space of time.

Certain basic features of federal legislation have been brought forward in each successive statute since 1963 with relatively little change. These include: (1) standard setting procedures whereby air quality control regions are designated and ambient air quality standards are set; (2) enforcement procedures, consisting of the conference--public hearing--court action process; and (3) the requirement for close intergovernmental cooperation, but with primary enforcement responsibilities upon the states and local governments. Even more significant than this continuity, however, has been the consistent expansion of federal authority and the shift of responsibilities for control to successively higher levels of government.

Major Federal Legislation

Since the passage of the Water Pollution Control Act of 1956, the legal framework for many forms of pollution control has been determined increasingly by federal legislation.¹ At this level, the legislative provisions for standard setting and enforcement have been developed to deal with water pollution and then adopted almost without change for air pollution.² The tendency to think of air and water pollution as very similar problems--and to act upon both with similar approaches to enforcement--is quite clear from the legislative history of major federal pollution control measures up to 1970, summarized in Tables 1-1 and 1-2.³

1. A chronological history of major environmental control legislation is contained in Appendix A.
2. Thus the water pollution enforcement procedures from the Water Pollution Control Act of 1956 were adapted for air pollution control in 1963, and the standard-setting process from the 1965 Water Quality Act was brought forward with minor modifications into the 1967 Air Quality Act. For a detailed analysis of water pollution legislative history through 1966, see M. Kent Jennings, "Legislative Politics and Water Pollution Control 1956-1961," in Frederic N. Cleveland and Associates, Congress and Urban Problems, (Washington, D.C.: The Brookings Institution, 1969); James L. Sundquist, Politics and Policy: The Eisenhower, Kennedy, and Johnson Years (Washington, D.C.: The Brookings Institution, 1968), pp. 322-381; and U.S. House of Representatives, Committee on Science and Astronautics, "Technical Information for Congress," April 25, 1969, pp. 337-356.

For a similar analysis of air pollution legislative events prior to 1966, see Randall B. Ripley, "Congress and Clean Air," in Cleveland and Associates, op. cit., and Sundquist, op. cit., pp. 322-381. For excellent analysis and summary of the forces which have shaped both air and water pollution legislation--Congress, the Executive Branch, public opinion, interests groups and state and local governments--see J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), especially pp. 37-146.

3. A chronological listing of all federal legislation relating to air pollution control up to 1971 is contained in Section 1.1 of the Annotated Bibliography.

Table 1-1

MAJOR FEDERAL WATER POLLUTION CONTROL LEGISLATION^a

Date	Title ^b	Major Provisions		Other
		Enforcement	Financial Aid	
1948	Water Pollution Control Act (P.L. 80-845)	Weak and cumbersome, heavily dependent on states	Loans for treatment plant construction	Temporary authority
1956	Water Pollution Control Act Amendments of 1956 (P.L. 84-660)	Conference-hearing court action process for interstate waters	Grants for treatment plant construction. \$50m annual authorization	Permanent authority
1961	Federal Water Pollution Control Act (P.L. 87-88)	Federal jurisdiction extended to navigable waters	Auth. of \$80m in 1962, \$90m in 1963, and \$100m annually 1964-67	Research on municipal treatment. Seven field labs authorized
1965	Water Quality Act (P.L. 89-234)	Federal-state standard-setting. Streamlined enforcement process	Auth. of \$150m in 1966 and 1967	Project grants for R&D on combined sewers
1966	Clean Water Restoration Act (P.L. 89-753)	Responsibility for Oil Pollution Act transferred to Secretary of the Interior	Auth \$450m in 1968, \$700m in 1969, \$1b in 1970, \$1.25b in 1971. Federal % of costs rose to up to 55%	Project grants for R&D on advanced waste treatment and on industrial wastes
1970	Water Quality Improvement Act	Stricter control of oil spills & hazardous pollutants. National Spill Contingency Plan	No additional authorization	Any activity which is federally regulated must have state certification that it will not violate water quality standards

a. Adapted and updated from J. Clarence Davies, III. The Politics of Pollution (New York: Pegasus, 1970), p. 39.

b. Despite differing titles, all legislation after 1948 actually constituted amendments to the Water Pollution Control Act.

Table 1-2

MAJOR FEDERAL AIR POLLUTION CONTROL LEGISLATION^a

Date	Title ^b	Major Provisions	
		Enforcement	Other
1955	Air Pollution Control Research & Technical Assistance Act (P.L. 84-159)		Research, demonstrations and training
1963	Clean Air Act (P.L. 88-206)	Conference-hearings-trial for interstate air pollution	Grants to state and local control agencies
1965	Motor Vehicle Air Pollution Control Act ^c (P.L. 89-272)	Federal regulation of emissions from new automobiles	Research on motor vehicle and sulfur oxides emissions
1967	Air Quality Act (P.L. 90-148)	Federal-state standard-setting for air quality control regions. Streamlined enforcement process	Registration of fuel additives. Establishment of advisory groups
1970	Clean Air Amendments (P.L. 91-604)	New motor vehicle emission standards, 1975	Encourage development of low emission vehicle; certification for new cars; regulation of fuel additives
		EPA to set national ambient air quality standards and oversee states' efforts to reach them	EPA may require polluter to monitor
		Performance standards for new sources; national emission standards for hazardous pollutants; expanded powers to enforce compliance; citizen suits	Federal procurement prohibited from convicted polluters

a. Adapted and updated from J. Clarence Davies, III. The Politics of Pollution (New York: Pegasus, 1970), p. 50.

b. Despite differing titles, all legislation after 1963 constituted amendments to the Clean Air Act.

c. The Motor Vehicle Act was Title II of P.L. 89-272. Title I consisted of minor amendments to the 1963 act and Title III was the Solid Waste Act.

As shown in Table 1-2, the first permanent federal air pollution control legislation was passed in 1963, and the enforcement provisions embodied in the Clean Air Act of that year followed the pattern of those already set for water pollution control. The Federal Government could take the initiative only in cases of interstate air pollution. In intrastate matters, a request for assistance from the Governor was a prerequisite. Once this was forthcoming, the Federal Government could hold a conference for interested parties within the state. If this conference did not produce results within six months, a public hearing could be convened, and if satisfactory action was still not obtained within another six months, the Federal Government could take the polluters to court. The delays in curbing pollution were so great under this procedure that mounting public pressure obliged Congress to consider further legislation. Attention in the meantime had been focused on automobile air pollution and Congress passed the Motor Vehicle Air Pollution Control Act in 1965. Two years later the Air Quality Act was passed with a view to accelerating the control of pollution from stationary sources.

The Air Quality Act of 1967¹

A highly complex legislative document, the Act attacked pollution on many fronts and is referred to on many occasions in this Compendium and its companion volume, Governmental Approaches to

1. Despite its title as the Air Quality Act of 1967, this legislation actually constitutes Amendments to the Clean Air Act of 1963.

to Automobile Air Pollution Control. In this chapter discussion is confined to the provisions relating to standard setting and enforcement for the control of pollution from stationary sources. Although the 1970 Amendments simplified and streamlined standard setting procedures and specified enforcement actions to be taken, the nature of both these processes was shaped in 1967 and the basic procedures were established at that time.

Standard Setting

The standard-setting procedures contained in the 1967 Act placed direct responsibility jointly on the states and the Federal Government. As set forth in the first section of the Act, the principle underlying this joint responsibility was the determination by Congress that, "the prevention and control of air pollution at its source is the primary responsibility of states and local governments,"¹ and "that Federal financial assistance and leadership is essential for the development of cooperative Federal, state, and regional, and local programs to prevent and control air pollution."²

The process of standard setting was to begin with the Federal Government designating "air quality control regions." The regions, which could be in one or more states, were to be based on jurisdictional boundaries, urban-industrial concentrations, and other atmospheric areas necessary to provide adequate implementation of

1. Air Quality Act of 1967, Sec. 101(a)(3).

2. Ibid., Sec. 101(a)(4).

air quality standards.¹ To the extent feasible, the designation of air quality control regions was to occur within eighteen months after the enactment of the Air Quality Act (which took place on November 21, 1967).

Simultaneously with the designation of air quality control regions, the Federal Government was required to develop and issue to the states "air quality criteria"² and data on control techniques for particular pollutants. Both the criteria and the data on control techniques were to be announced in the Federal Register and to be made available to the general public.³

The Federal Government, then, was to designate regional air quality regions, to issue criteria, and to recommend control techniques before the states could act. At this point each state included in an air quality control region had ninety days to file a letter of intent, stating that it would set appropriate air quality standards and controls for the pollutants covered by the criteria. After filing this letter, the states had 180 days to adopt the air

1. Air Quality Act of 1967, Sec. 107(a)(2). The Act also authorized the Secretary of HEW after consultation with state and local authorities, to review such regions as he determines necessary. With the establishment of the Environmental Protection Agency in December 1970, these and other responsibilities under federal air pollution control legislation were transferred to the Administrator of the Environmental Protection Agency.

2. Air quality criteria represent a compilation of the latest available scientific knowledge on the effects on public health and welfare of different levels of air pollutants (or combinations thereof). The criteria were designed to assist state and local governments in setting their own air quality standards.

3. Air Quality Act of 1967, Sec. 107.

quality standards applicable to each control region and 360 days to adopt an implementation plan.¹ The standards were to become effective when approved by the Federal Government.

If a state failed to file a letter of intent or establish air quality standards, or if the state's standards were not approved by the Federal Government, the latter could promulgate its own standards for the region.² In this case, the state was allowed an additional six months to adopt acceptable standards. If it failed to do so, Federal Government standards became effective for the region.³ States could then appeal standards set by the Federal Government to a hearing board if they so desired.⁴

1. Air Quality Act of 1967, Sec. 108(c)(1). It is important to recognize the distinction between two types of standards, one of which specifies air pollution control objectives, the other of which prescribes what polluters must do. The first, air quality standards, are specific quality levels of ambient air (e.g., no more than X micrograms per cubic meter of particulate matter over any 24 hour period) which are deemed acceptable for any given air quality control region. The second, emission standards, prescribe the nature and quantity of a pollutant to be allowed from any given source (e.g., no industrial plant may emit more than Y micrograms per cubic meter over any 24 hour period).

2. Air Quality Act of 1967, Sec. 108(c)(2). The Act also stipulated, however, that the Federal Government could take action on only "after reasonable notice and a conference of representatives of appropriate Federal departments and agencies, interstate agencies, states, municipalities, and industries involved. . ."

3. Ibid.

4. Ibid., Sec. 108(c)(3).

Enforcement Procedures

The Air Quality Act of 1967 set forth a series of steps to be followed in the designation of air quality control regions, the establishment of air quality standards and an implementation plan for those areas. These steps covered both interstate and intrastate pollution. In contrast, federal enforcement action under the Act was limited to interstate air pollution, except when federal action was requested by the governor of the state involved.¹ Accordingly, federal initiative in enforcement proceedings was possible only where pollution originated in one state but endangered the health or welfare of persons in another.² Thus, the major obstacle to federal enforcement under the 1963 Clean Air Act--the requirement that consent of the states be obtained--was retained in the 1967 legislation. Even when requested to act in an intrastate matter, the Federal Government had the right to decide whether or not a given case was of sufficient importance to warrant federal initiative.

The basic pattern for federal enforcement was also retained from the 1963 Clean Air Act:

1. The focus of federal enforcement on interstate pollution was first set forth in the 1956 Water Pollution Control Act and subsequently incorporated in the Clean Air Act of 1963. The Air Quality Act reference is to Section 108(c)(4).

2. Under the Air Quality Act, however, there was one significant exception to the interstate-intrastate differentiation. The Secretary of HEW was authorized to seek immediate federal court action in situations where pollution "is presenting an imminent and substantial endangerment to the health of persons" (Air Quality Act, Sec. 108(k)), and state or local authorities had not acted to abate it.

First, a conference is held under the aegis of the Federal pollution control agency. The conference established a schedule for cleaning up the pollution which allows at least six months for action to be taken. If at the end of six months sufficient progress has not been made, the Secretary may call a public hearing. There is a mandatory six-month delay after the public hearing and then, if compliance is still not satisfactory, the Secretary may request the Attorney General to bring suit against the polluters.¹

However, many of the lengthy and mandatory enforcement delays were eliminated with the Air Quality Act.

Under the 1967 legislation, the Federal Government could eliminate both the conference and the public hearing in bringing enforcement action. Violators had to be notified 180 days before legal action was taken, but after such notice was given and the required time had elapsed, the Attorney General could be requested to bring suit against polluters. Federal action, however, was dependent under the Air Quality Act upon establishment of air quality standards. But because air quality standards were slow to be established under the 1967 Act, this new, streamlined enforcement procedure was not applied.² Federal air pollution enforcement experience was limited in any event, but such as it was it took place

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 180.

2. There was some application for water pollution control. Under parallel provisions of the 1965 Water Quality Act the Secretary of the Interior in September 1969 gave formal notice to four steel companies and a mining company that they were violating water quality standards.

under the older 1963 procedure. Consequently, it is important to examine the conference-public hearing-court action process in some detail.¹

Conference. If the Federal Government found that pollution from one state was endangering the health or welfare of people in another, it could call an abatement conference of the pollution control agencies of all affected states and municipalities.² The conference, however, was legally a somewhat peculiar proceeding:

Although it is the first step in a legally defined process leading eventually to court action, the conference itself is not run under court-type rules and it is not considered to be an adversary proceeding. The individual polluters are not parties to the conference and, in water pollution conferences, they do not testify unless invited by the state control agencies. In 1967, the air pollution enforcement procedure was changed to require that all "interested parties" receive notice of the conference and an opportunity to present their views. The conference has been used as an informal meeting between the Federal control agency and its state and local counterparts for the purpose of mutually agreeing

1. It has been suggested that there are some advantages to the older picture. "The older conference-public hearing procedure has the advantage of being able to cover a large geographic area and a large number of polluters in a single action. An action under the new procedure, because it leads directly to court action, usually can only be applied to one pollution source at a time. Thus the older procedure may still be used in the future." J. Clarence Davies, III, The Politics of Pollution, (New York: Pegasus, 1970), p. 181.

2. The conference could be called only after "consultation with state officials of all affected states. . ." Air Quality Act of 1967, Sec. 108 (d)(1)(D), but it was obligatory if requested by a state governor, a state control agency, or a municipality, providing the governor and the state agency concurred. Ibid., Sec. 108 (d)(1)(B).

on a schedule of remedial measures, and also as a vehicle for publicizing the existence of pollution in a particular area.

Following the conference, the Federal Government was required to prepare and forward to all air pollution agencies attending the conference, a summary of the discussions, including: first, the occurrence of air pollution subject to abatement under the Act; second, the adequacy of abatement measures taken; and third, the nature of delays, if any, being encountered in abating pollution. If the Federal Government had reason to believe that effective progress was not being made, it had to recommend "the necessary action" to the appropriate air pollution control agency. From the date that such recommendations were made a waiting period of at least six months was required.²

Public Hearing. If remedial action had not been taken at the conclusion of this period the Federal Government was required to call a public hearing. The public hearing was a more formal process than the initial conference:

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 181. Likewise, John S. Esposito, Vanishing Air (New York: Grossman, 1970) p. 113, observes: "A conference resembles a town meeting presided over by a representative of the Secretary. Although official participation is limited to state, local, and Federal officers, interested citizens (including the offenders) may--indeed, are encouraged--to testify. The proceeding is nonadversary, without administration of oaths or extensive cross examination. (Only official participants are allowed to ask questions.) The aim is public consultation, not prosecution."

2. Air Quality Act of 1967, Sec. 108(3)(e). As indicated above, the conference-public hearing-court action process was first set forth in the 1963 Clean Air Act.

It takes place before a hearing board which consists of five or more persons appointed by the [HEW] Secretary. Each of the states involved in the case can appoint one member of the board, and a majority of the members of the board must be persons who are not employees of the Federal Department which initiated the enforcement action. The alleged polluters--whether an industry, individual or governmental unit--are made direct participants in the hearing. Findings are made by the hearing board on the evidence presented, and it recommends to the Secretary the measures which must be taken to abate the pollution. The Secretary, if he approves the hearing board's findings and recommendations, sends them to the polluters and the state agencies along with a notice specifying a schedule for the accomplishment of the abatement measures.¹

In short, the hearing duplicated much of the conference, but in an adversary setting. Once again, violaters were given "a reasonable time" of not less than six months to comply with the recommended pollution abatement.²

Court Action. If the polluter was still recalcitrant after the additional allotted time, the Federal Government could ask the Attorney General to bring suit in the appropriate U.S. District Court. The next step was not clear, both because of limited experience in filing pollution control suit in Federal court and because of the legal uncertainties attaching to the final enforcement stage. As of 1970, when new enforcement procedures were provided under the Amendments to the Clean Air Act, only one case in water pollution

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 182.

2. Air Quality Act of 1967, Sec. 108(f)(3).

and one in air pollution had been brought to court.¹ The legal situation at the court action stage was equally uncertain. The 1967 Air Quality Act directed the court to receive in evidence (i) "a transcript of the proceedings before the board," (ii) "a copy of the board's recommendations," and (iii) "such further evidence as the court in its discretion deems proper."² But the burden of proof remained unclear. For, as pointed out in a recent report, the Act also stated that:

1. The water pollution case was brought against the city of St. Joseph, Missouri. The one air pollution case has been summarized as follows by the President's Council on Environmental Quality:

The first air pollution enforcement action was instituted in 1965 against a chicken rendering plant in Bishop, Md. A conference was held in 1965 and a public hearing in 1967; a suit was begun in the Federal district court in 1969, and an appeal finally made to the U.S. Supreme Court. The plant was not shut down until the Supreme Court refused to hear the appeal in May 1970--5 years after the action started. No other enforcement action has proceeded beyond the conference stage.

The Council added:

No enforcement has yet taken place under the 1967 act, since the standards, for the most part, have not yet been adopted nor implementation plans approved. The President has submitted comprehensive proposals to the Congress to strengthen enforcement powers.

First Annual Report of the Council on Environmental Quality, Environmental Quality (Washington, D.C.: Government Printing Office, August, 1970), pp. 75-76.

2. Air Quality Act of 1967, Sec. 108(h).

The court must give 'due consideration to the practicability of complying with such standards as may be applicable and to the physical and economic feasibility of securing abatement of any pollution proved.' The lawyers for the National Coal Policy Conference interpret that to mean a de novo trial (i.e., starting from scratch for the third time) with the burden of proof on the government. In any event, the court has jurisdiction to enter such judgments and orders 'as the public interest and the equities of the case may require.' This means that the judge may order abatement by a certain date, close down the plant, or do nothing at all.¹

Performance under the Air Quality Act

Although viewed at the time of its passage as a significant legislative achievement, pollution control performance under the Act proved to be disappointing. Between 1967 and 1970, public pressure mounted steadily on the Federal Government to control air pollution, and there was widespread feeling in both Congress and the executive branch that existing measures were inadequate. Many legislative proposals were introduced during the 91st Congress to improve or extend air pollution control, and Congressional discontent was voiced by Senator Jennings Randolph, Chairman of the Senate Committee on Public Works, during the March 1970 air pollution hearings:

Mr. Chairman, I am not a carping critic, but I do want to say that I am disappointed to note the hesitant manner in which the Air Quality Act of 1967 has been implemented. The administration has moved neither far enough nor fast enough in taking the steps toward establishing controls over air pollution.

1. John C. Esposito, Vanishing Air (New York: Grossman, 1970), p. 114.

The Department of Health, Education, and Welfare originally estimated that it would have designated 57 air quality control regions by April of this year. That deadline was later postponed to December of 1970.

At this time, however, fewer than half the designations--25 on January 1, I believe--have been made.

I think it is important, Mr. Chairman, for me to state, as chairman of the Public Works Committee, that there seems to have been too little urgency in publishing the criteria and technology available for achieving the objectives of the 1967 act.

Since these are to be the foundations on which the standards for control of individual pollutants are set and accomplished, the air pollution control program is in serious danger of being shortchanged.

Prior to yesterday,¹ we had knowledge of criteria published for only two pollutants and information on four control technologies.²

Senator Randolph blamed the Federal Government for a general lack of progress, and especially for failure to designate air quality control regions and publish air quality control criteria. Yet much of the blame lay elsewhere, as asserted in the first Annual Report of the President's Council on Environmental Quality issued in the summer of 1970.

The report pointed out that many administrative problems were still unresolved at state level. State enforcement of air pollution control was lagging far behind that of water pollution.

1. March 16, 1970.

2. U.S., Congress, Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2d sess., p. 126.

Only ten state air quality standards had been approved; and no state implementation plans had been approved at all. Thus, there was no basis for enforcing standards since state enforcement had to await federal approval of implementation plans. This situation was partly the result of interlocking procedures laid down in the 1967 Air Quality Act and the consequent requirement for close intergovernmental cooperation.

The Council also stressed that, despite the apparent similarities between air and water pollution, the methods of control and the implementing institutions for each were distinctly different:

The air pollution effort is not as advanced as available technology for a number of air pollutants, although most forms of industrial water pollution are amenable to control. Second, state water pollution control agencies have existed for many years in the United States and have developed capabilities, although often limited. Until enactment of the Air Quality Act of 1967, air pollution control was largely conducted by local agencies. Few states had adequate manpower and resources. Finally, the Air Quality Act of 1967 is no longer an adequate tool to cope with current pollution problems. Procedures for development and implementation of air quality standards are too slow and place an inordinate burden on both the states and the Federal Government.¹

Finally, the Council noted that present procedures under the Air Quality Act were inadequate:

. . .the Federal Government has no jurisdiction if the pollution from one state is not endangering health and welfare in another state, unless the governor of the state in which the pollution

1. First Annual Report of the Council on Environmental Quality, Environmental Quality (Washington, D.C.: Government Printing Office, August 1970) p. 86.

occurs requests help. The current conference-hearing procedure is unduly cumbersome and time consuming. The only court action that can be requested by the government against a polluter is a cease-and-desist order, and the only available remedy in the case of noncompliance is to hold the polluter in contempt of court. The current act does not provide for fines to compel compliance.¹

The need for new legislation was also emphasized by Administration spokesmen that fall, notably by William D. Ruckelshaus, nominee to head the Environmental Protection Agency. On December 2, 1970, Mr. Ruckelshaus was confirmed as Administrator of EPA. The new agency had comprehensive environmental control responsibilities and encompassed 15 units from other federal agencies. It included all existing agencies and authority at the federal level for air pollution control, notably the National Air Pollution Control Administration. Two weeks later a compromise over Senate and House versions of new air pollution control legislation was reached and on December 31, 1970, the President signed into law the "Clean Air Amendments of 1970."² The Amendments are both tough and far-reaching. It is too early to determine how the new legislation will work in practice. But it is certain that the 1970 legislation sets the basic framework for pollution control in this country for at least the next 5-10 years.

1. First Annual Report of the Council on Environmental Quality, Environmental Quality (Washington, D.C.: Government Printing Office, August 1970) p. 86.

2. P. L. 91-604, 84. Stat. 1676.

The Clean Air Amendments of 1970¹

The 1970 Amendments,² which include the strongest air pollution control legislation ever passed by Congress, make several very significant changes in the Clean Air Act. While the most important sections of the Amendments deal with national ambient air standards and the states' implementation of these standards, the following discussion also outlines other significant sections, such as those dealing with performance standards for new sources, national emission standards for hazardous pollutants, and emergency powers granted to the Administrator of the Environmental Protection Agency, the public official now responsible for administering federal air pollution control legislation.³

National Ambient Air Quality Standards

Standard Setting. Perhaps the most significant and controversial change directed by the 1970 Amendments is the switch from ambient air quality standards established by the states to national ambient air quality standards. These national ambient air quality standards, to be determined by the Administrator of

1. As in previous sections, this discussion pertains to stationary source provisions only. Mobile source provisions--some of which were among the most controversial of the new legislation--are discussed in Institute of Public Administration, Governmental Approaches to Automobile Air Pollution Control, Report submitted to the Office of Air Programs of the Environmental Protection Agency, Washington, D. C., 1971. (Mimeographed.)

2. P.L. 91-604, 84 Stat, 1676.

3. 42 U.S.C. 1857 et seq.

EPA (hereafter called the "Administrator") consist of both primary and secondary standards. Primary standards are those standards necessary to protect public health, while secondary standards are standards which protect the public welfare from adverse air pollution effects. For each air pollutant there will be both a primary and a secondary standard.

National ambient air quality standards are set through a relatively simple process. The Administrator has only to issue proposed national primary and secondary standards for each pollutant, along with appropriate air quality criteria (issuance of criteria was discussed earlier under the standard-setting provisions of the 1967 Air Quality Act). Interested persons are allowed 90 days to submit their comments and then the Administrator promulgates the final primary and secondary standards. For the few pollutants (sulfur oxides, particulates, carbon monoxide, hydrocarbons, and photochemical oxidants) for which air quality criteria had already been published, the Administrator was given 30 days to develop proposed standards, followed by the normal 90-day comment period. On April 30, 1971, final ambient air quality standards were issued for these five pollutants after receipt of over 300 comments.¹

The speed with which these standards were finalized is indicative of the improvement in the standard-setting process

1. In addition, final primary and secondary standards were promulgated for nitrogen dioxide.

resulting from the 1970 Amendments. The new provisions, which remove public hearings, eliminate at least 180 days and, in some cases, as much as 22 months from previous procedures.

Implementation of Standards. In contrast to the situation before 1970, the 1970 Amendments enumerate rather specifically what the states must do to insure that national ambient air quality standards are met. Up to 1970 the Federal Government did little to guide or control the way in which states chose to implement their standards. To satisfy federal requirements, previously, a state needed only to submit a plan which was consistent with federal air quality criteria and control techniques, and to provide for state enforcement to assure achievement of air quality standards within a reasonable time. These requirements were substantially less specific than those included in the 1970 Amendments.

Under the 1970 Amendments the states must meet a number of specific requirements. After the Administrator has issued national ambient air quality standards for a particular pollutant, the states have to provide a plan showing how the state will meet the standards. The states are allowed nine months to submit these implementation plans after national ambient air quality standards have been issued, although the Administrator may allow a state up to an extra 18 months in which to submit an implementation plan for secondary standards.

State implementation plans are reviewed by the Administrator, who must approve or disapprove them within four months. The

Administrator must be satisfied that the state's plan meets eight conditions.¹

1. The plan must provide for attainment of the national standard as soon as possible, with no longer than three years to be permitted to achieve a primary standard;
2. The plan must include emission limitations, schedules, and timetables for compliance with these restrictions. While emission limitations are expected to be the primary air pollution control technique, the plan must include other measures necessary for achieving the standards, particularly land use and transportation controls;
3. The plan must provide for monitoring ambient air quality, as well as compilation and analysis, of the resulting data. This data must be made available to the Administrator;
4. The plan must include a procedure for review of the location of new sources (see the section later on "Performance Standards for New Sources");
5. The plan must provide for cooperation between governmental units to insure that air pollution from one air quality region does not impair air quality in another region;
6. The plan must (i) provide assurances that the state will have adequate personnel, funding, and authority to carry out its implementation plan, (ii) require installation of monitoring equipment by dischargers into the air, (iii) provide for periodic reports on individual emissions, (iv) provide for availability to the public of records correlating emission reports and limitations, and (v) provide for authority to restrain immediately pollution which is an imminent danger to public health;
7. The plan must provide for periodic testing of motor vehicles to enforce compliance with emission standards; and

1. See Section 110(a)(2)(A-H) of the Clean Air Amendments of 1970.

8. The plan must provide for revision of the implementation plan if the national ambient air quality standards change or if the Administrator determines that the plan cannot achieve the national standards.

The Amendments allow the Administrator to establish an implementation plan if he does not approve a plan or if no plan has been submitted by a state. If the Administrator does not approve some part of an implementation plan, the state has 60 days in which to make the appropriate revision. If the requested revision has not been made or no plan has been submitted, then the Administrator may promulgate an implementation plan which becomes effective six months later if the state has not submitted an acceptable plan in the interim.

Under rather limited circumstances, the Administrator may grant a one-year compliance postponement to a particular pollution source if requested to do so by the Governor of the state in which the source is located.

Inspections, Monitoring, and Entry

Owners and operators of any emission source may be required by the Administrator to install and maintain monitoring equipment as well as sample their emissions and make information on them available. In addition, owners and operators must allow representatives of the Administrator access to monitoring equipment and emission records at all times. Any information or records required must be made available to the public, unless the Administrator agrees with the owner or operator that a trade secret is involved. This requirement appears to make available to the public records which could be of considerable value in the prosecution of private pollution cases.

Air Quality Control Regions

Under the law up to 1970, the first step towards air pollution control was the designation of air quality regions. The 1970 Amendments greatly accelerated the completion of designation of air quality control regions so that all regions in the country had been designated by March 31, 1971.

The designation of air quality control regions was completed in two steps. First, previously designated regions were retained without change. Second, all portions of a state which were not part of a previously designated region were lumped together as one region, unless the Administrator approved a breakdown by the state government of remaining areas into two or more regions. These two steps were subject to the Administrator's right to change the areas covered by a region, provided he did so by March 31, 1971.

Performance Standards for New Sources

Under this section, the Federal Government regulates "standards of performance" for all new stationary sources of air pollution. "Standard of performance" is defined to mean a standard "which reflects the degree of emission limitation achievable through the application of the best system of emission reduction" which has been demonstrated (emphasis added). This in effect establishes a national standard for all new sources that does not take into account differences in local ambient air quality or other factors.

In order to promulgate performance standards for new sources, the Administrator must declare that a particular category of air pollution sources endangers the public health or welfare.

Within 120 days after such a declaration, the Administrator must propose regulations establishing federal standards of performance within the category. The public is allowed to comment on the regulations for 90 days, after which the Administrator shall promulgate the final regulations.

Each state may develop a plan implementing the performance standards for new sources. If the plan is approved by the Administrator, he may delegate to that state the authority which he has to implement and enforce the standards. If a state does not submit an implementation plan for a category upon which final regulations have been issued, then the Administrator may make an implementation plan for the state in the same way that he may prepare implementation plans for national ambient air quality standards.

National Emission Standards for Hazardous Air Pollutants

National emission standards must be established for air pollutants which are hazardous because of their potential effect upon public health, and yet for which there is no applicable ambient air quality standard. Under the 1970 Amendments, the Administrator was required to publish a list of hazardous pollutants by March 30, 1970.¹ Six months later national emission standards must be issued. A public hearing must be held within 30 days of the issuance of national emission standards, and the Administrator must promulgate

1. On March 30 the Administrator declared asbestos, mercury, and beryllium to be hazardous air pollutants.

final national emission standards within six months after publication of such standards. Standards for hazardous pollutants are to be set at a level which provides an ample margin of safety to protect public health.

After the final regulations are published, there is a 90-day grace period after which no one may emit in violation of the standard unless he receives permission from the Administrator. This waiver can be granted for up to two years, but only if all steps necessary to installation of control technology are being taken and public health will not be affected. No new source, including modification of an existing source, may be constructed which will discharge a hazardous air pollutant unless the Administrator certifies that the source will not violate the standard. If the Administrator feels that a state has developed an adequate plan for enforcing emission standards for hazardous pollutants, then he may delegate his authority to control sources of such pollution in that state.

Enforcement

Insuring Compliance. The 1970 Amendments markedly expand the scope and potential effectiveness of federal enforcement. Before 1970, the Federal Government could bring suit only if:

1. the ambient air quality fell below the applicable air quality standards;
2. the lowered air quality resulted from failure of a state to take reasonable action to enforce the standards; and

3. the level of pollution was endangering the health or welfare of persons in a state other than that in which the discharge originated.

In these circumstances, the Federal Government could go to court to secure abatement. If the pollution was endangering only the health and welfare of persons in the state in which the pollution originated, then the Governor of the state had to request aid in enforcement before the Federal Government could intervene. Because of the weakness of these enforcement provisions, the burden of insuring compliance was on the states, with the Federal Government offering encouragement.

The 1970 Amendments provide significantly greater enforcement power than existed under the Clean Air Act because the Administrator is permitted to enforce compliance with any aspect of an implementation plan. To do this, the Administrator notifies a discharger of his violation of a plan; and if 30 days later there is still a violation, then the Administrator can either issue an order requiring compliance or initiate a civil suit against the violator. If civil action is initiated, a court may grant an injunction or any other relief it considers appropriate. If a compliance order is violated, then criminal penalties of up to \$25,000 per day or one year imprisonment are available. Upon a second conviction, the possible fine and period of imprisonment double. These enforcement provisions apply to national ambient air standards, new source performance standards, hazardous pollutant standards, and the inspections, monitoring and entry requirements.

While the old conference enforcement procedure is retained under the new provisions, it is limited to enforcement situations where there is no applicable national primary or secondary ambient air quality standard. This limitation reduces the conference procedure to, at best, a supplementary role in the federal enforcement scheme.

The 1970 Amendments permit action not only against polluters but also against a state which fails to enforce its pollution control plan. If, after giving 30 days notice, the Administrator determines that the state's performance is inadequate, then he may enforce any requirement of the state's implementation plan.

In the 1970 Amendments, it is important to note that Congress chose to continue to place the burden of air pollution control enforcement in the United States upon the states. Because Congress chose to continue this focus, the 1970 Amendments function primarily as a further prod to the states to control air pollution within their boundaries, rather than as a means of national enforcement by the Federal Government.

Emergency Powers. The Federal Government's emergency powers remain essentially unchanged by the 1970 Amendments. The Administrator may go to court to enjoin a polluter if there is "an imminent and substantial endangerment to the health of persons" and state or local authorities have not acted to abate the source. Under the 1967 Air Quality Act, however, this emergency authority was never formally used (see below, "Inadequate Agency Manpower").

Federal Facilities

The 1970 Amendments require all branches of the Federal Government to comply with federal, state, interstate, and local requirements respecting control and abatement of air pollution to the same extent that any person is subject to such requirements. However, the President may exempt any emission source if he determines it to be in the paramount interest of the United States to do so, except that no exemption may be granted for new stationary sources, and an exemption from provisions relating to hazardous pollutants may be granted only in the interests of national security. These requirements are much stricter than the pre-1970 requirements, which required compliance only to "the extent practicable and consistent with the interests of the United States."

Citizen Suits

The 1970 Amendments allow a private citizen to sue any person, including the government, for violation of an emission standard or limitation, or for violation of an order of the Administrator. In addition, a private citizen may sue the Administrator when he fails to carry out any act which is required of him. However, suit cannot be brought if 60 days notice has not been given by the private citizen to the Administrator, the state control agency, and to the alleged polluter. Furthermore, no suit is permitted if either the state or Federal Government is prosecuting a suit against the polluter. In addition, the Amendments allow the Administrator to become a party

to any suit filed under the Amendments by a private citizen, who does not give up any other rights by initiating the action.

Federal Procurement from Polluters

If a party is convicted of an offense punishable by the Clean Air Act, then no federal agency can contract with that person for goods or services. This prohibition applies only to the actual polluting facility and does not preclude a contract for goods and services coming from a non-polluting facility of the same party. The prohibition will be lifted when the Administrator certifies that the condition which led to the conviction has been corrected.

The President is required to issue a directive by the end of June, 1971, which orders all federal agencies to use their contract, grant, and loan powers to support the policies of the Clean Air Amendments of 1970. The President is given power to apply appropriate sanctions to insure that his directive is followed.

Outlook for the Future

Prior to the past decade, air pollution control was primarily the responsibility of local government. Increasingly, however, it has become a matter of interaction among agencies from all levels of government. Federal legislation has reinforced the programmatic interdependence of pollution control, i.e., the need for any pollution control agency to share responsibility with other levels of government in order to obtain its objectives. States must depend upon the Federal Government for standard setting. The Federal Government, in turn, must rely heavily upon state and local governments for enforcement. It is too soon to say how these shared responsibilities will work out, but the next few years will witness a trial period to test their effectiveness.

The administration of air pollution control will require complementary action from many agencies at various levels of government. This requirement for intergovernmental cooperation, however, may facilitate inaction. If the past history of pollution control--and specifically the lack of state interest and experience in air pollution control, at least until very recently--is any indication, it will prove difficult to obtain agreement among all governmental participants on pollution control programs. Furthermore, it will be relatively easy for one level of government to obstruct or delay the proposals of another. Eventually, this may mean that the Federal Government will have to intervene increasingly in implementing air pollution control.

In the meantime, the evolution of intergovernmental action on air pollution will depend upon both the exercise of formal controls and responsibilities--specifically under the Clean Air Act, as amended--and the pattern of informal contacts and communication--consisting of voluntary cooperation among air pollution control professionals, bargaining and negotiation, influence, assistance and advice. The former, it must be recognized, provides only the framework for intergovernmental action on pollution control. The latter must be developed intensively if control is to be carried out by cooperative interaction.

What is the effect of Federal Government intervention--both formal and informal--on the pace of air pollution control? What measures can be taken to facilitate action by the intergovernmental system? What are the major bottlenecks in state and local enforcement efforts? What can be done to improve and develop inducements for control of air pollution by the public sector, i.e., by government air pollution control agencies? These are all areas beyond the scope of this report. However, since the intergovernmental process is probably one of the most susceptible parts of any pollution control program, a systematic study of this area should, in our judgment, be a first priority area for further research. The following section merely attempts to identify some of the major trends and to pinpoint some of the potential problem areas.

The Federal Role¹

Two trends loom large in the evolution of the federal role in air pollution control over the past twenty years. First, the Federal Government role has grown rapidly, with the increased assumption of power and responsibility as evidenced by the ever expanding federal air pollution control legislation. Second, the federal role has become increasingly active. Previously, federal air pollution control officials saw themselves as providers of advice and technical assistance to state and local agencies. Particularly in the late 1960's this role of neutral competence was gradually replaced with a far more active federal stance, in response to the pressure of public demands and the enactment of new and far-reaching federal legislation. This larger and more active federal role has been reinforced by the 1970 Clean Air Amendments. The Amendments devolve myriad duties upon the EPA Administrator and his staff. Among other responsibilities, EPA must promulgate and periodically review ambient air quality standards. EPA must publish and periodically update air quality criteria and control technology data. EPA must review and (where appropriate) revise state implementation plans--and ultimately EPA may have to prepare and implement many state plans itself. EPA must designate performance standards for new stationary sources and emission standards for hazardous air pollutants--and ultimately EPA

1. A systematic review of the major literature on the federal role in air pollution control is contained in Section 3.1 of the Annotated Bibliography attached to this compendium.

may have to develop and administer implementation plans for these purposes as well. Likewise, EPA has monitoring and inspection responsibilities, as well as broader enforcement powers than previously. And the above list is not exhaustive.

Given these massive responsibilities, it is too early to tell whether EPA will be capable of carrying out the new and extended federal authority, particularly in light of current manpower and money limitations and the deadlines set forth in the 1970 Amendments. Even under the best of circumstances, however, EPA will have to rely heavily, at least initially, upon state and local governments for enforcement.

The Amendments and subsequent EPA guidance to the states have gone far to specify what will be required of state authorities in air pollution control. Under the Act, EPA would set standards and the states (or subdivisions thereof) would assume most of the burden of enforcement. At the present time, however, the administrative capabilities of most state and local pollution control agencies are limited (see below, "The State Role").

For the immediate future, at least, it also seems unlikely that the Federal Government will embark upon large scale enforcement against individual polluters.¹ To begin with, this would require taking many cases to court, a task which is generally recognized as

1. These conclusions draw upon insights developed on the federal role in air pollution control in J. Clarence Davies, III, "The Purpose of Federal Enforcement," The Politics of Pollution (New York: Pegasus, 1970), p. 184 ff.

beyond the capabilities of EPA's present manpower and resources. Furthermore, and notwithstanding the new enforcement authority granted EPA under the 1970 Clean Air Amendments, the control of individual pollution sources is still recognized in the legislation as the responsibility of state and local governments.¹

Given these constraints, the primary federal role in enforcement will probably be to prod state and local control agencies into taking action. This is likely to be done in three ways:

(1) the provision of technical assistance in pinpointing problems and their possible solutions; (2) the mobilization of public opinion to demand that state and local agencies take action; and (3) the threat of eventual federal enforcement if states fail to comply.

1. The Clean Air Act, as amended, states: "The Congress finds. . . that the prevention and control of air pollution at its source is the primary responsibility of States and local governments." Sec. 101(a)(3).

The State Role¹

The larger and more active federal role in air pollution control does not impinge on the role of the states, except in some specific cases. Under the 1967 Air Quality Act, for example, states were responsible for establishing ambient air quality standards; but under the 1970 Clean Air Amendments, this responsibility was shifted upward to the Federal Government. In a more important sense, however, federal air pollution control legislation has served to extend authority and responsibility at both the federal and state levels. Thus, states have been stimulated to take on responsibility and authority they never had before.

Until relatively recently, the interest of most states in controlling air pollution was "minimal or nonexistent:"

Insofar as control efforts were made they were made by local government, usually in the large cities where the problem was most acute. The first state air pollution act authorizing enforcement at the state level was passed by Oregon in 1952, and only eighteen states had passed legislation before 1963.²

During the past decade, responsibilities for air pollution control have shifted upward, first to the county or regional level and then, following passage of the 1967 Air Quality Act, to the

1. A review of the major literature on state and local roles in air pollution control is contained in section 3.2 of the Annotated Bibliography attached to this compendium.

2. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus Press, 1970), pp. 125-126.

states.¹ This trend can be expected to continue under the 1970 Act. For one thing, states must now meet more stringent requirements. For example, they must adopt and submit to EPA by February 1972 a plan to implement and maintain air quality standards. This action could be delayed indefinitely under previous legislation. Furthermore, the new legislation also offers increased financial incentives for state action, in terms of federal funding for 75 percent of a state's costs to plan, develop and implement air pollution control programs, and 60 percent of its costs to maintain them. Previously, these subsidies were available only for programs involving two or more states or municipalities.

Short of special surveys on a state-by-state basis, it is difficult to say how states will respond to the 1970 Clean Air Amendments and the detailed guidance issued by EPA (see below, "Inadequate State Authority"). In recent years, however, the trend has been toward statewide air pollution control programs.² As of 1970, the states also seem to be tending toward the establishment of unified environmental protection agencies, within which are

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus Press, 1970), pp. 128-130.

2. These statewide programs, however, usually allow for a continuation of local control programs where these programs have been in existence for some time and where the standard setting and enforcement procedures are deemed satisfactory. At the municipal level, cities such as Chicago and New York have enacted comprehensive air pollution codes and have created an authorized agency to deal with air pollution. At the regional level, the largest and most important example is the Los Angeles County District, with a jurisdiction of over 4000 square miles and 71 cities within the county. Interstate compacts are another organizational approach, but have not been widely used for air pollution control.

grouped responsibilities for air pollution, water pollution, solid waste, etc.

The actual pattern of administration for air pollution control programs, of course, will differ from state to state and will not be fully known until submission of state implementation plans. Some programs will probably be administered on a state-wide basis from the capital. Others will be administered by regional air pollution control officers working for the state. And still others will delegate authority to major municipalities or air pollution control districts.

Whatever the pattern of administration, the major enforcement responsibility will rest, at least initially, upon the states. The success of this effort will depend in large measure upon the administrative capability of state pollution control agencies. Based upon past experience and available information, however, there is little reason to think that most states will be soon ready to assume the task mandated them under the 1970 Clean Air Amendments. Two problems are particularly likely to prove considerable in the coming years: the inadequacy of most states' air pollution control authority and shortages of manpower, especially professional personnel.

Inadequate State Authority

For at least the next five years, the inadequacy of existing state authority will probably be a critical obstacle to implementing air pollution control. Under the 1970 Clean Air Amendments, state air pollution control agencies will need substantially

more legislative authority than previously. The Amendments require states to adopt and submit to EPA a plan to implement and maintain air quality standards by February 1972.¹ In a February 1971 letter to all state governors and legislative leaders, EPA Administrator Ruckelshaus said that implementation plans would not be considered satisfactory unless state air pollution control officials have statewide authority to:

- (1) Adopt emission standards and limitations and any other measure necessary (e.g., limitations on the sulfur content of fuels) for attainment and maintenance of national ambient air quality standards.
- (2) Enforce without delay applicable laws, regulations, and standards, with appropriate sanctions, including authority to seek injunctive relief.
- (3) Abate pollutant emissions on an emergency basis to prevent substantial endangerment to public health, i.e., authority comparable to that available to EPA under section 303 of the Clean Air Act.
- (4) Establish and operate a statewide system under which permits would be required for construction and operation of new stationary sources of air pollution and construction and operation of modifications to existing sources. Authority to prevent such construction, modifications, or operation, and any other necessary land use control authority also is required.
- (5) Obtain information necessary to determine whether air pollution sources are in compliance with applicable laws, regulations, and standards, including authority to require record-keeping and to make inspections and conduct tests of air pollution sources

1. As noted earlier, six national ambient air standards were set by EPA on April 30, 1971. With the promulgation of these standards, the timetable is set for state enforcement. State implementation plans are due within nine months of this date, i.e., by the end of January, 1972.

(6) Require owners or operators of stationary sources to install, maintain, and use emission monitoring devices and to make periodic reports to the state on the nature and amounts of emissions from such stationary sources; also authority to make such data available to the public as reported, and as correlated with any applicable emission standards.

(7) Carry out a program of inspection and testing of motor vehicles to enforce compliance with applicable emission standards when necessary and practicable, and other authority necessary to control transportation.

The letter also stated that regional implementation plans developed under previous federal legislation would be reviewed. However, at that time, no state plan could qualify for approval in all categories.

The burden thus placed upon states--in terms of developing these seven specific kinds of legislative authority in less than a year--is enormous, particularly when it is recognized that most states have only recently enacted statewide air pollution control legislation. Furthermore, even the existing state statutes are very variable, and it is doubtful that any state can meet EPA requirements without enacting new legislation.

As set forth in the EPA Administrator's letter, states must now have statewide authority to establish permit systems. As of mid-1968, however, less than half of the states had such enabling legislation.¹ Another requirement is for state authority to abate

1. See Richard Aborn and Carl Axelrod, "Air Pollution Legislation", 9 B.C. Comm. & Ind. L.R. 712 (1968), p. 727, fn. 90. This article, probably the best available review of state air pollution control legislation in the aftermath of the 1967 Air Quality Act, contains an excellent analysis of the two basic types of state pollution control programs: the prohibitory system and the permit system.

on an emergency basis. However, as of 1969, over one-third of the states did not have such a provision in their air pollution control legislation.¹ Nearly every state has considered these and other control provisions within the past few years or is considering them now. And as of 1970 all 50 states had air pollution control legislation of some sort.²

Nevertheless, there are substantial gaps in state air pollution control legislation when compared to the 1971 requirements of EPA. EPA has promised to provide the states with guidance, advice and financial assistance to insure that all states have satisfactory pollution control authority. However, state implementation could be delayed if legislatures--by either inaction or opposition--fail to enact the necessary enforcement, inspection and testing authority. It is too soon to say how state legislatures will respond to the new requirements, but the deadline of February, 1971 seems to make some statutory shortcomings inevitable.

1. Stanley Degler, State Air Pollution Control Laws (Washington, D.C.: Bureau of National Affairs, 1969), pp. 4-5.

2. Stanley Degler, State Air Pollution Control Laws, rev. ed. (Washington, D.C.: Bureau of National Affairs, 1970), p. 1.

Inadequate Agency Manpower

At least during the next 5-10 years, the shortage of professional personnel could well be the most important bottleneck in implementing air pollution control. Such shortages of skilled personnel are common, even in the federal enforcement effort. A recent study of federal enforcement experience, for example, points out that powers enabling the Federal Government to deal with potential sources of air pollution (e.g., a proposal to construct a large paper mill) have not been formally used, largely because of limitations on air pollution control manpower at the federal level and the pressure to deal with existing pollution sources.¹

Even more significant is the limited administrative capability of most state air pollution control agencies.² As indicated above, the premise that responsibility for control of air pollution at its source rests primarily with state and local government has prevailed since the earliest federal legislation on the subject. Under the 1967 Amendments to the Clean Air Act, a number of specific responsibilities were placed squarely on the states. Furthermore, the Act established procedures for federal intervention if a state failed to act or its action was deemed inappropriate by the Federal government. Among other things, states were to (1) effectively monitor ambient air quality; (2) adopt appropriate regulations to control

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970); p. 183.

2. Although attention here is focused on the states, most of what is said applies to local air pollution control agencies as well.

stationary source pollution; (3) answer complaints and conduct inspections to assure compliance with applicable regulations; (4) develop evidence and take appropriate action against non-complying emitters; and (5) assure that air pollution was prevented when and where it could be. Given the historically limited state role in air pollution control, the administration of these activities required a major expansion in state manpower for this function. In addition, many of the specialized personnel now needed were professionals in short supply -- environmental engineers, chemists, meteorologists and so forth.

Stimulated by the availability of federal funding for state control efforts beginning in 1965, and the stiffened requirements for state action under the 1967 Amendments to the Clean Air Act, many states moved to expand their air pollution control staffs. From 1965 to 1969 there were increases for budgeted positions of approximately 32 per cent per annum in state air pollution control agencies.¹ Nevertheless, most state programs were still inadequate in terms of personnel. As of the end of 1969, 50 percent of state air pollution control agencies still had fewer than 10 full time positions.

1. Data on state agency staffing taken from Manpower and Training Needs for Air Pollution Control, a report of the Secretary of HEW to the Congress of the United States (Government Printing Office: June 1970), p. 3. The figure refers to numbers of personnel, not funds. According to Table A-4, p. 29, of the same report, only nine states, as of late 1969 had air pollution control staffs of more than 25.

Recruitment of competent personnel was also a problem. Over the entire period 1967-69, approximately one-half of the positions for which state control agencies were recruiting remained unfilled.

Perhaps more importantly, state pollution control personnel were required to adjust to new statutory requirements and unfamiliar administrative procedures. As pointed out by a recent federal report on air pollution control manpower and training needs:

The concept of adoption of ambient air quality air standards and basing emission restrictions upon the degree of improvement required from existing ambient air quality levels was an unfamiliar procedure to almost all of the States. Such a system requires adequate knowledge of existing ambient air quality and information on prevailing meteorologic conditions which affect the diffusion and transport of emitted pollutants.¹

The same report estimated that state and local air pollution agency staffs need to be increased from 2,837 (the level of budgeted, but not necessarily filled) positions in 1969 to about 8,000 in 1974. The 1974 staffing level represents an increase of 180 per cent over the number of positions budgeted in 1969 and an increase of 270 per cent over that year's actual employment.²

1. Manpower and Training Needs for Air Pollution Control, a report of the Secretary of HEW to the Congress of the United States (Government Printing Office, June, 1970), p. 2.

2. Ibid., pp. 3-5.

Admittedly, many programs are under way to provide personnel for these state and local agency requirements.¹ Even so, state and local agency manpower needs are critical, and substantial efforts will have to be taken if the predicted manpower needs for 1974 are to be met. In addition, it should be noted that the 1970 Amendments to the Clean Air Act--and the action taken to date by the Environmental Protection Agency to administer the new legislation vigorously--promise another major expansion of air pollution control activities. Some of these new activities mandated by the 1970 legislation were not taken into account by the above-cited estimates, since at the time these were prepared the new legislation was still under consideration by Congress. For example, as noted above, the new legislation requires that state implementation plans include, but not be limited to, land use and transportation controls. At present, most states simply do not have the capability to prepare such controls anywhere in their administrative agencies, let alone in the air pollution control office.

As air pollution control agencies adopt new control regulations concerning a greater spectrum of sources and pollutants, and as they increase the scope of their enforcement action, more manpower--in particular, more professional personnel--will be increasingly required. What manpower requirements must be met will depend, among

1. These include federal recruitment and detail of personnel to state and local agencies, support for undergraduate training, post-graduate training for state and local agency employees, centralized job registers, and improvements in state and local agency salaries and merit system classifications.

other things, upon the workload involved in various air pollution control programs, the age and size of the agency and so forth.

Whether these requirements can be met will depend upon the supply of professional personnel, the availability of training programs, the adequacy of salary levels¹ and other related factors. The answers to these and related questions, however, must await further research not covered in this contract. And eventually, as state air pollution control programs evolve, an in-the-field evaluation on a state-by-state basis will probably be necessary.

1. In a 1967 study it was found that "State and local median salary levels for engineers and scientists are as much as 20 to 50 percent below the median for industry as a whole." R. C. Cluster, "State and Local Manpower Resources and Requirements for Air Pollution Control," APCA Journal, Vol. 19, No. 4 (1969), pp. 217-223. Cited in Manpower and Training Needs for Air Pollution Control (Washington, D.C.: Government Printing Office, 1970), p. 5

CHAPTER 2

VOLUNTARY COMPLIANCE

Compliance has been defined as "the process whereby existing pollution is halted or reduced or potential pollution is prevented."¹

As used in this compendium, voluntary compliance occurs when this process takes place without the formal legal sanctions of government being brought directly to bear. Thus defined, it is apparent that any air pollution control program depends upon voluntary compliance to a very great degree.²

Air pollution control agencies can encourage voluntary compliance in two ways: (1) through techniques such as education, persuasion and negotiation; and (2) through approaches such as emission standards, land use controls, emission charges and so forth.

The present chapter is concerned with the former techniques. Strictly speaking, these techniques cannot be said to constitute an approach

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 176.

2. The necessary dependence of any air pollution control program on a high degree of voluntary compliance by industry arises from two aspects of the air pollution control problem. First, since air (unlike water) cannot be centrally treated, control of air pollution must take place at each polluting source, with most of the effort and expenditure coming from the private sector. Second, no air pollution control agency has the resources to prosecute more than a small fraction of individual polluters. Consequently, air pollution control programs, like other law enforcement programs, must rely heavily upon voluntary compliance if their purpose is to be achieved. These aspects, and their significance for all approaches to air pollution control, are stressed in the "Summary and Conclusions" section of this chapter and throughout the compendium.

to air pollution control. By themselves (i.e., in the absence of the approaches discussed in succeeding chapters of this compendium), these techniques can usually achieve only very limited voluntary compliance. As one federal air pollution official points out, ". . .very little air pollution has been abated without legislation, litigation or the threat of such action."¹

Nevertheless, these techniques usually constitute an important component of most air pollution control programs, for, within the legal framework of state and local statutes and the federal legislation discussed in Chapter 1, there are many ways in which the government can encourage voluntary compliance, and "most agencies rely on techniques such as persuasion, negotiation, and education far more than on formal legal sanctions."² With this in mind, the following chapter examines the experience to date with voluntary compliance on the part of industry and the ways in which government can use such techniques to encourage greater voluntary compliance in the future. Attention is addressed to the experience at the federal level, although most of the discussion has relevance for state and local air pollution control agencies as well.

Experience with Voluntary Compliance

The immense and growing popularity of environmental quality as a political issue in this country plus the strong pressures from

1. William H. Megonnell, "Air Pollution Control--Everyone's Responsibility," Presentation at the MASS-APCA Spring Technical Conference, Rutgers University, May 13, 1970, p. 4. (Mimeographed.)

2. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 176.

both pollution control agencies and public interest groups are now having their effects on the private sector. Particularly in recent years, private industry is exhibiting an increasing degree of concern with the environment; and increased investment by the private sector for pollution control bears witness to this concern. Total expenditures for air pollution equipment (including some application for process controls) are estimated at about \$100-\$125 million annually. The annual rate of increase since 1967 has been on the order of 10 percent. This increase has been somewhat greater than total industrial investments in new plants and equipment.¹ As a further indication of their participation in pollution control programs, many large companies have established high-level management policy-making groups or environmental departments. Several large companies have also indicated that company policy will consider the environmental implications of any proposed capital expenditures.

Again, prominent representatives of private industry have recently entered into an advisory arrangement with the Federal Government for the purpose of mutually exploring problems associated with environmental quality. In April of 1970, the National Industrial Pollution Control Council was created by President Nixon as an advisory board in the Department of Commerce. The Council consists of 62 chief executives drawn from every major category of American industry. It also has 30 sub-councils with responsibilities for particular industries. By its own account, the Council "is an

1. Information from Paul Gerhardt, Chief Economist, Office of Program Development, Air Pollution Control Office, October 29, 1970.

organized source of industry advice to the President and to the Council on Environmental Quality on industry programs to clean up pollution and improve the quality of the environment."¹

Creation of the Council offers much potential for voluntary compliance actions. In releasing the first report of the Council, Secretary of Commerce Stans stated, ". . .government now has a highly informed and dedicated source of advice to government on the practicalities of environmental quality improvement as well as a direct link to the leaders of industry who will get the job done."²

The Council has been extremely active in compiling industry reports describing pollution control problems in such industries as paper, detergent, and plastics. To date, the Council has submitted three sets of reports (November, 1970; February, 1971; and April, 1971). In addition, the Council has issued a "massive illustration" of what industry is doing to help control pollution.³ This report compiles the responses obtained from over 160 companies who replied to a request made by the Council in November, 1970 for a review of voluntary actions by industry in the areas of water, air, noise, and waste pollution. In air pollution control, the report states that

1. "First Report of the National Industrial Pollution Control Council," Bert S. Cross, Chairman (Washington, D.C.: July 14, 1970).

2. U.S. Department of Commerce News, G 70-87, July 14, 1970. Conversely, as an advisory board attached to the Department of Commerce, the Council could become a powerful advocate within the Federal Executive for slowing the pace of pollution control.

3. National Industrial Pollution Control Council, Casebook, Pollution Clean Up Actions (Washington, D.C.: 1971). For further examples, see NIPCC, Commitments, Industry Cleanup Actions in Progress (Washington, D.C., 1971).

electrostatic precipitators, wet scrubbing, and conversion from coal to gas or low-sulfur oil are being employed by most concerns to reduce particulate and sulfur oxide emissions. The report also cites numerous innovations in control technology now used and a considerable number of research programs currently under way.

Although the National Industrial Pollution Control Council is the most significant industry-related group attempting to encourage voluntary compliance, there are many others. The U. S. Chamber of Commerce, for example, is active in urging "business-led action to improve air and water quality."¹ The Chamber has established an Environmental Pollution Advisory Panel to direct its efforts, which mainly center upon assisting local chambers of commerce to develop pollution control projects. Trade associations in specific industries are also active in urging their members to take action to control pollution.² The American Petroleum Institute, for example, has created an Office of Air and Water Quality.

Voluntary Compliance in the Airline Industry

Despite the apparent interest of industry in air pollution control, there has been only one major attempt by industry and the Federal Government to discuss together the specifics of a voluntary compliance plan. This was the attempt by NAPCA to secure voluntary

1. Chamber of Commerce of the United States of America, Improving Environmental Quality (Washington, D.C.: 1970).

2. On the other hand, trade associations can obstruct air pollution control by representing the lowest common denominator of their members' views.

compliance on the part of the airlines to install "clean" combustors (or "burner cans" as they are commonly called) in some of their turbine engines. Such a conversion would virtually eliminate the dense black plume of smoke and reduce the total emission of air contaminants by 75 percent from these engines.

Although there have been other examples at lower levels of government, and many other instances of less formal attempts, the airlines industry example provides perhaps the best insight into techniques such as exhortation by public officials, negotiation with polluters, and so forth. This experience clearly brings out one central lesson: that government must support these techniques with air pollution legislation, the threat of legal prosecution, or similar measures in order to motivate industry to move rapidly to control pollution. For these reasons, the NAPCA attempt to elicit airline industry voluntary compliance will be examined extensively here.

Legislative Mandate. The Air Quality Act of 1967 directed the Secretary of Health, Education and Welfare to conduct "a full and complete investigation of controlling emissions from jet and piston aircraft and of establishing national emission standards with respect thereto. . ."¹ In December of 1968, Secretary Wilber J. Cohen submitted to Congress the required report of his findings and recommendations. The report recommended that "reduction of

1. Air Quality Act of 1967, P.L. 90-148, Sec. 211(b).

particulate emissions from jet aircraft is both desirable and feasible."¹ It indicated that the technology was available for the improvement of turbine engine combustor design both for new engines and by retrofit to certain engines already in use. The report concluded:

While there are no laws or regulations to compel the industry to follow through on this work [installing smokeless combustors], it appears that public pressures resulting primarily from the adverse effects of odors and visibility obscuration will lead industry to initiate the application of this technology as soon as possible and to complete it within the shortest possible time. Accordingly, it is the intention of this Department to encourage such action by engine manufacturers and airline operators and to keep close watch on their progress.²

However, lest the yielding of the initiative be misunderstood as a sign of weakness, the HEW Secretary declared:

If, at any time, it appears that progress is inadequate or that completion of the work will be unduly prolonged or that the concern of industry lags, the Department will recommend regulatory action to the Congress that statutory authority for such action be provided.³

Thus, the stage was set and the curtain drawn wide to observe the response of the airlines to this appeal for voluntary compliance.

1. U.S., Congress, Senate, Nature and Control of Aircraft Engine Exhaust Emissions, S. Doc. 91-9, 90th Cong., 2d sess., 1968, p. 4.

2. Ibid.

3. Ibid.

First Meeting. The task of urging voluntary compliance on the airlines was undertaken by NAPCA.¹ NAPCA convened a meeting in Washington, D.C., on August 23, 1969, for the purpose of getting concrete assurances from the industry that a reasonably rapid schedule would be used to retrofit the approximately 3,000 Pratt and Whitney JT8D gas turbine engines currently in use.² These engines, which power the Boeing 727 and 737 and the McDonnell-Douglas DC-9, contribute about 70 percent of all weighted jet smoke plumes produced in this country.

The NAPCA case for industry compliance could hardly have been stronger:

1. Technology Available. In conference with engine manufacturers prior to the meeting, HEW definitely ascertained that smokeless combustor cans would be available early in 1970, and, in fact, had already been certified for safety by the FAA.

2. Low Cost. In a comprehensive study commissioned by NAPCA, the Northern Research and Engineering Corporation explored the financial and scheduling implications of changing to the improved combustor design.³ The cost of retrofit if done at the time

1. The chief NAPCA negotiator and chairman of the meeting was William H. Megonnell, Assistant Commissioner for Standards and Compliance. Mr. Megonnell has reviewed this case study and feels the facts are stated accurately and the conclusions drawn fairly.

2. Retrofit was the only real concern of the meeting as manufacturers had previously given their assurances that the new generation of wide-bodied aircraft would be delivered virtually smokeless.

3. Northern Research and Engineering Corporation, "Time Requirements for Retrofitting Jet Aircraft with Improved Combustor Designs" (Cambridge, Massachusetts: July, 1969).

of the first major engine overhaul¹ was conservatively estimated to be \$3,000 per engine per year. If this cost were passed on to the consumer it would result in a fare increase of cen cents on a \$100 ticket.

3. Flexibility. NAPCA's position was one of great flexibility. Their intention was for the airlines to sign a memorandum of intent, "a type of gentleman's agreement to indicate their [airlines] intention, their public spiritedness and good will in a meaningful, positive way. It will provide us with substantive information to report to Congress and to the public on the plans of the airlines and, periodically, on their progress toward reducing or eliminating emissions from aircraft."² A proposed draft of such a memorandum was distributed, but NAPCA emphasized that it was to be considered only a working tool and subject to much revision based on the particular problems of airlines (though it was felt strongly that the feasible completion date determined by Northern Research and Engineering Corporation, April 1972, was a reasonable one.)³

Twenty-four of the airlines attending the meeting (including all of the major carriers) chose to be represented by the Air

1. Northern Research and Engineering Corporation, "Time Requirements for Retrofitting Jet Aircraft with Improved Combustor Designs" (Cambridge, Massachusetts: July, 1969). The choice of the first major overhaul as the basis for requiring retrofit was actually quite reasonable. Replacement at a faster rate was felt to unfairly tax the airlines' limited maintenance facilities. Replacement at a slower rate, i.e., when combustors wear out, would take twice as long with only a minor cost savings (\$250 per engine per year).

2. Transcript of Proceedings, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combustors on Jet Aircraft (Washington, D.C.: August 28, 1969), pp. 16-17.

3. The NAPCA argument for voluntary compliance as well as the Air Transportation Association statement (which follows) is abstracted from Transcript of Proceedings, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combustors on Jet Aircraft (Washington, D.C.: August 28, 1969).

Transport Association.¹ In general, ATA objected strongly as to the necessity and legitimacy of the meeting:

1. Problem Overrated. ATA felt the jet engine emission problem was receiving too much attention in view of the fact that it contributed only about 1 percent by weight of the man-made pollutants placed in the atmosphere by all sources. Consequently, ATA contended, jet engine emissions create "an esthetic rather than a health problem."²

2. Implementation Delay Required. At the time of the meeting, 4,000 test hours were logged using the new combustors. ATA argued that more than twice as many test hours were necessary to make sure the "yet unproven" burners would not disrupt maintenance cycles and create difficult problems in maintenance scheduling.

3. Costs Understated. ATA argued that the cost figures provided by Northern Research and Engineering Corporation were probably understated by a factor of two. Furthermore, ATA maintained that, owing to the precarious financial position of the airlines, the financial impact of adding combustors would be substantial and possibly disastrous.

4. Impossibility of Fixed Schedule Commitment. Too many unknowns precluded the establishment of any definite schedule for retrofit, it was argued, although ATA thought it safe to say that the majority of engines would be smokeless by the mid-70's. ATA also argued that using the first major overhaul period as the basis for conversion was not acceptable. Instead, the old combustors should be replaced on an attrition basis. Said the ATA negotiator, "I would guess that they [the airlines] would want to get all the use they can out of good parts which are on the shelf. I think that's the prudent way to do business."³

1. The Air Transport Association was represented by General Clifton F. von Kann, U.S.A. (ret.).

2. Transcript of Proceedings, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combustors on Jet Aircraft (Washington, D.C.: August 28, 1969).

3. Ibid, p. 47.

ATA concluded its statement somewhat defiantly by indicating that the industry had a substantial program already in motion, that intrusion by the Federal Government could not effect any speedier compliance, and, in fact, was a source of industry-wide resentment:

The airlines have expressed to me their surprise that your Administration feels that any memorandum . . . is needed on the subject of jet engine improvement. Maybe airline reaction, as well as ours, is caused by the fact that heretofore no U.S. Government Agency has interceded with an agreement when a voluntary program was being actively pursued by the airlines. In any event, the airlines feel that any agreement along the lines of that proposed is not needed.¹

After some clarifying questions were asked, and it was apparent that the meeting was firmly deadlocked, NAPCA adjourned the session. The first meeting between NAPCA and the airlines had lasted little more than two and a half hours.

Summary of First Meeting. In December of the same year, Dr. John T. Middleton, NAPCA Commissioner testified before the House Subcommittee on Public Health and Welfare. He was questioned by Congressman Rogers about the jet aircraft problem. Expressing his reaction to the August 28 meeting described above, Middleton stated: "The airlines were not responsive to our requests. . . We could come

1. Transcript of Proceedings, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combustors on Jet Aircraft (Washington, D.C.: August 28, 1969), p. 33.

to no agreement on having a voluntary action. I considered the meeting not only a disappointment, but also a clear expression of disinterest on the part of the airlines."¹

In opening the August 28 meeting, NAPCA had stated that "our future in seeking voluntary compliance will in large measure be guided by our experiences here today. Truly this is an experiment, the test of industry's good will and expression of concern."² On the basis of the first meeting, one is forced to conclude that the experiment failed, that the results of the test were negative.

In addition to the factors mentioned in NAPCA's August 28 statement, there were other considerations previous to the meeting that would have appeared to augur well for the prospects of voluntary compliance. The airlines, heavily regulated and subsidized, appeared to be concerned about not taking demonstrative action with regard to a popular national issue. Image was a major preoccupation of the airlines as they were in daily contact with their consuming public and because competition was limited almost exclusively to advertising. The image they sought to maintain was certainly not compatible with black smoke and foul odors. In sum, the first meeting's results did not appear to bode well for the future of voluntary compliance, although hardly could conditions have been more ripe for a voluntary compliance agreement.

1. U.S., Congress, House, Committee on Interstate and Foreign Commerce, Subcommittee on Public Health and Welfare, Hearings, Air Pollution Control and Solid Waste Recycling, Part 1 (1969), 91st Cong., 1st sess., p. 90.

2. Transcript of Proceedings, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combustors on Jet Aircraft (Washington, D.C.: August 28, 1969), p. 47.

Action Against Airlines. A number of factors were at work, however, which soon resulted in the airlines' reconsidering their position. In early 1969, the California legislature passed a bill which drastically curtailed permissible aircraft emissions by January 1, 1971. On August 12, 1969, the State of New Jersey filed suit against seven airlines operating out of Newark Airport. A \$1,600 fine was set for each takeoff and landing violation of the state's air pollution control code. A similar suit against 21 airlines using Chicago's O'Hare Airport was filed shortly thereafter by the State of Illinois. Moreover, there was little to indicate that more suits and/or legislation would not follow.

Second Meeting. The target date set by New Jersey for a retrofitting schedule was February 9, 1970. Although only seven airlines were named in the suit, the New Jersey action apparently served as strong impetus for another meeting of the airlines and government. Subsequently, on January 20, 1970, the individual airlines met with Secretaries Finch and Volpe, FAA Administrator Schaeffer and NAPCA Commissioner Middleton. The Air Transport Association, which had figured prominently in the previous meeting, was not invited to attend. In less than two hours, there was agreement as to the precise wording of the joint press release to be issued following the meeting.

The key statement in the press release was the vague assurance that the retrofitting program would be substantially completed by late 1972:

The Departments of Transportation and Health, Education and Welfare today announced that representatives of virtually all the nation's airlines have agreed to a program of sharply reducing smoke emissions from aircraft jet engines. Secretaries John A. Volpe of Transportation and Robert H. Finch of HEW said top officials of 31 carriers represented have agreed to begin within 90 days the installation of smoke reduction devices on the affected aircraft. Depending upon the availability of the devices, improvement is expected to be noticeable within the next few months, and the program substantially completed by late 1972.¹

So non-specific was this statement that shortly over a week later the State of New York filed suit against 18 airlines, hoping in part to improve on the installation timetable.²

It is useful to identify the underlying reasons for the change in attitude by the airlines--from little interest at the initial meeting to a more or less flexible posture at the next session. Certainly California legislation, the proliferation of law suits and the threat of more of the same were the major factors. The airlines apparently felt that the commitment they would have to give the Federal Government would be much less stringent than that which would be required of them by state legislatures or courts. In addition, the airlines probably felt that a court fight would tarnish their image, while a voluntary compliance agreement would improve their posture as a public-spirited industry. And, perhaps most important of all, as opposed to the results of litigation, the voluntary commitment they made was, by definition, unenforceable.

1. HEW NEWS, January 20, 1970.

2. New York Times, January 29, 1970.

The change in the Government's bargaining attitude also deserves consideration. Some evidence exists to indicate that the Government's desire to relax the conditions which were set forth in the first meeting and subsequently to accept the airline's assurance was motivated by a desire to "pre-empt the field [legislation concerning jet aircraft emissions] with a national game plan."¹ There is also the possibility that the Federal Government wanted to establish a precedent of success in voluntary compliance negotiations.

In conclusion, the problems posed by vague language in the meeting's concluding statement may well plague future voluntary compliance agreements. Non-specific statements are always likely to be accepted when there are conflicting viewpoints. But if voluntary compliance is to capture the public's confidence, government negotiators in future meetings may have to be specific as to what is and what is not acceptable, even at the risk of upsetting the low-key rapport which ideally would prevail at voluntary compliance negotiations.

Encouraging Voluntary Compliance

The above discussion has been based primarily upon the concrete experience of one attempt at voluntary compliance. While this experience suggests some useful lessons, it provides only part of the picture. This section will attempt to complete the picture and, in so doing, will make the insights of the airline's case study more explicit. Accordingly, an attempt is made to isolate the key variables which together determine the extent to which a firm will

1. Transcript of Proceedings, NAPCA/FAA/Airline Industry Meeting (Washington, D.C.: January 20, 1970), p. 3.

voluntarily comply with environmental control measures.¹ Since it will be shown that many of these variables are capable of direct manipulation by government, the following section also will serve to focus attention on the crucial role government must play in eliciting voluntary compliance.

Financial Impact

The likelihood of a particular firm abating its pollution is most importantly dependent on the cost of abatement in comparison to the company's resources. Where the cost will threaten bankruptcy or place a firm at a serious disadvantage with respect to its competitors, there can be, of course, but little expectation of voluntary compliance. On the other hand, if the cost of pollution control is so small as to be insignificant, voluntary compliance most likely will occur.

To offset the costs of pollution control equipment, industry has lobbied intensively for governmental subsidies. Cost sharing arrangements and economic incentives have the potential to radically alter the financial impact of compliance and hence encourage voluntary compliance. These approaches are discussed respectively in Chapters 6 and 7 of this volume.

The impact of abatement costs on a firm's financial health is particularly acute for small firms since such firms often find it

1. The availability of control technology is, of course, a crucial factor. However, the discussion below will assume the state-of-the-art of control technology for most industries is sufficiently well developed so that firms can comply without running large risks of installing expensive but ineffective equipment.

necessary to install air pollution abatement equipment almost as expensive as that installed by much larger firms in the same industry. Since a disproportionate share of small businesses are very old, small firms have additional financial costs in compliance--partly because most of the value of existing equipment has already been written off and the plant will be replaced much sooner than a new plant, but also because little research is devoted to pollution abatement for processes which are very old. Furthermore, these high control costs have to be borne for plants which can be expected to operate for only a few years longer.

For these reasons, many small businesses simply cannot afford to purchase and install pollution abatement equipment. But even when the business can clearly afford equipment required by performance standards, there may be difficulty in obtaining financing. The banking community, which is frequently very reluctant to loan to small businesses for productive investments, may consider air pollution abatement equipment as "unproductive." Intensifying the problem is the fact that small firms are often located in small towns and at the mercy of conservative small town bankers. The extent to which small businesses are denied loans for pollution control equipment is not presently known. However, it is fairly clear that a substantial increase in voluntary compliance could result from programs designed to assist small businesses in meeting the high costs of pollution control.

Coercion

Although coercion would perhaps appear inconsistent with the strategy of "voluntary" compliance, as the airline industry's example strongly indicates, there can be little doubt that "arm-twisting" of one sort or another will play a key role in eliciting voluntary agreements. Aside from the cost of compliance, the pressure the government can bring to bear on industry is probably the single most important factor in motivating the private sector to voluntarily comply with pollution control measures. Among the techniques government can use to induce industry compliance, the threat of legal enforcement is perhaps the most powerful.¹ As Louis Fuller, former Los Angeles County Air Pollution Control officer, puts it, "Reasonable discussion with polluters about remedial steps is important, but there has to be the knowledge that if they don't shape up they're going to land in court as sure as God made little apples."²

The credibility that government has when threatening enforcement action depends heavily on the quality and effectiveness of the regulatory agency. As one expert concludes, "If the agency is willing and able to enforce the regulations against polluting industries, and if the industries are reasonably sure that all

1. Legislation to facilitate private class action suits against polluters may open viable, new avenues of legal pressure (see Chapter 5). If this is indeed the case, the threat of legal enforcement may become even more effective in motivating compliance than it is at present.

2. New York Times, October 19, 1969, p. 61:1. In J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 185.

competitors in the area are to be treated alike, then there will probably be a high degree of voluntary compliance."¹ Thus, although the threat of legal enforcement (as explained in the outset of this chapter) in itself may not curb many polluters, the pace and process of legal enforcement is undoubtedly a significant input into industry's decisions about pollution control and is probably closely monitored by industry as a measure of the "risks" they are taking by continuing to pollute.

Another powerful government pressure can be the threat of stringent legislation. Such threats almost always accompany federal pleas for voluntary compliance. Repeatedly, threats of stringent legislation were made in both meetings with the airlines,² in the HEW Secretary's report to Congress,³ and in Dr. Middleton's testimony.⁴ Compliance may take place to avoid such legislation⁵ or,

1. New York Times, October 19, 1969, p. 61:1. In J. Clarence Davies, 'III, The Politics of Pollution (New York: Pegasus, 1970), p. 91.

2. Transcript of Proceedings, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combustors on Jet Aircraft (Washington, D.C.: August 28, 1969), pp. 3-4, 66. Transcript of Proceedings, NAPCA/FAA/Airline Industry Meeting (Washington, D.C.: January 20, 1970), pp. 2-3.

3. U.S., Congress, Senate, Nature and Control of Aircraft Engines Exhaust Emissions, S. Doc. 91-9, 90th Cong., 2d sess., 1968, p. 4.

4. U.S., Congress, House, Committee on Interstate and Foreign Commerce, Subcommittee on Public Health and Welfare, Hearings, Air Pollution Control and Solid Waste Recycling, Part 1 (1969), 91st Cong., 1st sess., p. 90.

5. The New South Wales System (Chapter 9) provides an interesting example of compliance to avoid stringent legislation. The existing fine schedule for failing to comply is trivial and, by itself, could hardly be expected to deter polluters. The high degree of voluntary compliance observed is generally attributed to the knowledge polluters have that government can and will increase the fines in order to secure compliance.

when dealing with the Federal Government, to pre-empt legislation on the part of lower jurisdictions.¹ As indicated above, both motives were important in the airlines' decision to agree to a relatively rapid retrofit schedule.

Governmental pressure may be intensified by the involvement of high government officials in negotiating with industry. The interest and attention of officials may be taken by industry as an indicator of government's determination to control the pollution in question. Suggestive of the influence of such pressure is that the first meeting of the government with the airlines was chaired by a NAPCA assistant commissioner, while the final and decisive meeting had no less than two cabinet members and two federal agency administrators.

Public Opinion

Adverse publicity, of course, detracts from the image business tries, in differing degrees, to maintain. It is difficult to generalize about the sensitivity of firms to public opinion since it depends heavily on the character of the corporate managers. Those large firms which sell to the public under their own name or whose business brings them into daily contact with consumers are generally more sensitive to public relations and often take the lead in

1. The enactment of federal legislation can pre-empt more stringent state or local legislation. This can occur statutorily as in the case of motor vehicle and aircraft emissions, or informally as it may "satisfy" a lesser jurisdiction's need for control legislation (although perhaps weaker than the jurisdiction would have enacted itself).

publicizing the need for pollution controls. This is especially true during the past few years which have witnessed a tremendous growth in public concern about the quality of the environment. In recognition of this growing sentiment, many companies and industry groups have initiated public relations programs aimed at enhancing their pro-environment posture. The automobile manufacturers, for example, have departed from their long-standing "low profile" attitude concerning the environmental impact of their products and have launched a major campaign to educate the public about their pollution control efforts.¹ Public interest groups have been particularly effective in mobilizing public opinion against polluters and in identifying false or misleading statements in their environmental advertising.

The forces of public opinion are so strong, at present, that the Federal Government reports that firms are extremely sensitive to adverse publicity. Some large firms, previously involved in well-publicized enforcement proceedings, purportedly feel that their names now have strong negative associations with consumers.² Thus, although it is difficult to generalize about the power of potential adverse publicity to motivate compliance, it is clear that this consideration is becoming an increasingly significant factor in the pollution control strategy of many large industrial firms.

1. For example, see Jerry M. Flint, "Auto Industry Opens Counter Attack on Environmental and Consumer Movement," New York Times, November 18, 1970, p. C-29.

2. Information received from William H. Megonnell, APCO Assistant Commissioner for Standards and Compliance, Washington, D.C., May, 1971.

Voluntary compliance, on the other hand, can do much more for a firm's public relations program than simply preclude adverse publicity. As Secretary Volpe pointed out to the airlines during their second meeting, "I can think of many places where you can spend millions of dollars in advertising, and I think none of it would pay off as well, in my humble opinion, as the dollars you will spend in this retrofit operation which the public can see and appreciate."¹

Political Influence

The political influence of a firm becomes an important determinant of compliance behavior if the anticipated costs of compliance eat heavily into profits. As the costs of abatement rise, it is to be expected that firms will attempt to apply whatever political pressure they can bring to bear at all levels of government.

Simply put, the political influence of a firm is directly related to its size, its importance to the economy, and probably also the degree to which it is normally involved in dealing with government agencies. The political strategies of firms vary widely. Some take the offensive and apply pressure on legislatures to pass industry-sponsored legislation; others employ defensive tactics such as cultivating procedural delays.² As discussed below, these tactics are

1. Transcript of Proceedings, NAPCA/FAA/Airline Industry Meeting (Washington, D.C.: January 20, 1970), p. 37.

2. For specific examples of the diversity of political strategies used by industry to mitigate the costs of pollution control, see J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), pp. 95-96.

often so effective that some industry observers advocate enforcing strong antitrust laws to reduce the economic power which is often the basis for political influence.

"Clear and Consistent" Public Administration

According to the National Industrial Pollution Control Council, an important step toward voluntary compliance would be to eliminate "conflicting regulations, overlapping governmental jurisdictions, and inconsistent standards."¹ The Council argued that if a "clear, consistent and stable legal and administrative framework within which to plan and work"² can be established, it will allow for the long periods of planning and investment which doubtless will be needed before effective cleanup action can take place.

From the standpoint of industry, it is clear that consistency and stability on the part of government are desirable prerequisites if industry is to act voluntarily before pollution occurs, or abate once it is happening. As one authority has emphasized, consistency and stability³ on the part of government are essential

1. "First Report of the National Industrial Pollution Control Council," Bert S. Cross, Chairman (Washington, D.C.: July 14, 1970). The Clean Air Act Amendments of 1970 which permit the establishment of national performance standards for categories of new sources is an important step in the resolution of these difficulties.

2. Ibid.

3. Consistency and stability refer both to the time dimension as well as the nature of how the responsibilities are shared by government.

to encourage action by industry, particularly of a preventive nature.¹ If standards are established and can be viewed as relatively stable, new industrial plants or new municipal facilities can incorporate parameters for pollution control into the plans so as to insure compliance with the standards. However, if standards are constantly changing, industry will be less likely to take appropriate control measures which may only result in costly modifications at a later date to meet more stringent standards. Similarly, uneven enforcement will militate against many firms voluntarily complying with pollution control measures for fear of being placed at a competitive disadvantage with non-complying firms.

Antitrust Laws

The application or possible modification by government of antitrust laws can impact importantly on voluntary compliance actions by industry. Great controversy, however, surrounds the manner in which such governmental regulatory power is to be used. On the one hand, antitrust laws can be used to prevent conspiracy and promote competition in the development of pollution control technology; on the other hand, stringent enforcement (or realistic threats of such enforcement) could possibly prevent meaningful co-operative research.

The U. S. Department of Justice currently takes the position that strong antitrust laws are needed. For example, the head of the Department's Antitrust Division, Richard W. McLaren, recently declared that he opposed all but "a minimum" of collaboration

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 191.

among industrial competitors working on anti-pollution devices. He stated that this nation's economic policy "favors the competitive rather than the joint industry approach." McLaren also emphasized:

. . . too often business collaborators on cost, research, and development and other 'mutual' interests stray into anticompetitive arrangements. At the worst, members decide to hold back development of an improved system. . . We would urge that collaboration among competitors be kept to a minimum, and that firms be permitted to exchange research and feasibility information only upon a strong showing by the proponents that the collective approach will yield substantial net gains.¹

This reluctance to permit industry to jointly pursue pollution control research and development is largely based on the experience with the automotive manufacturers. In January, 1969, the Johnson Administration filed suit charging the nation's big four auto manufacturers and their trade associations with conspiring to delay development and installation of anti-pollution devices on cars. The Nixon Administration settled the case by a consent decree in September, 1969.²

Other governmental officials are unwilling to view this experience as an indication that industry cannot be entrusted to

1. Richard W. McLaren, Speech to Antitrust Section of American Bar Association (April 1, 1971). Cited in Environment Reporter, Vol. 1, No. 50 (1971), pp. 1350-1351.

2. The debate about the use of antitrust laws in the automotive industry (an industry characterized by a close knit group of large sellers) clearly sets forth the difficult issues that must be resolved in using antitrust policy to promote research and development. See the accompanying volume, Institute of Public Administration, Governmental Approaches to Automobile Air Pollution Control, a report to the Air Pollution Control Office, Environmental Protection Agency, Washington, D. C., May, 1971, pp. 1-25 to 1-32.

pursue joint research and development or to establish self-policing programs. Speaking at the same meeting, Alan G. Kirk, II, Deputy General Counsel for the Environmental Protection Agency, suggested there may be:

. . .environmental problems confronting some industry groups, such as the automotive people, that can be solved more quickly, more efficiently, and more in the public interest by a joint undertaking. . . I am not anxious to energize the antennae of Mr. McLaren's Division, but I do wonder whether all technological problems are best hammered out on the forge of unrestrained competition.¹

Senator Philip A. Hart, Chairman of the Senate Judiciary Antitrust Subcommittee, is unwilling, however to permit less stringent enforcement of antitrust regulations. Hart feels any exemptions from existing antitrust law to allow companies to pool talent and resources are, in effect, "a 'carte blanche'--and a very strong temptation for the industries to combine in efforts other than the reason for the exemption."² In the main, Hart takes the position that antitrust laws should not be relaxed but made stronger to curb economic power. As explained above ("Political Influence"), this would reduce the political leverage often used by large companies to prevent enactment of government regulations or to weaken or frustrate the enforcement of such regulations.

1. Alan G. Kirk, II, Speech to Antitrust Section of American Bar Association (April 1, 1971). Cited in Environment Reporter, Vol. 1, No. 50 (1971), pp. 1350-1351.

2. Philip A. Hart, Speech to Antitrust Section of American Bar Association (April 1, 1971). Cited in Environment Reporter, Vol. 1, No. 50 (1971), pp. 1350-1351.

Summary and Conclusions

As stated at the outset of this chapter, any air pollution control program depends upon a high degree of voluntary compliance.¹ This necessary dependence arises from two aspects of the air pollution control problem which differentiate it from some other areas of environmental control (e.g., water pollution). From the standpoint of control, air, unlike water, cannot be purified on a large scale after pollutants have entered. Hence, control of air pollution must take place at each separate source of pollution, before pollutants enter the air. Whereas water pollution can be controlled by constructing a public facility (e.g., a waste treatment plant), air pollution control must rely upon the decentralized actions of numerous individual private sector polluters.

The implications of these differences, as one authority points out, are very great:

. . . They mean that much more of the effort and expenditure to control air pollution must come from the private sector than is the case in water pollution. They mean that in water pollution the government can offer some kind of service, namely, centralized treatment, but that in air pollution the government is almost exclusively a regulator and coercer. And they mean that scarcity of public funds is perhaps the major problem in controlling water pollution, whereas in air pollution political power to enforce regulations and the degree of voluntary compliance will be the deciding factors.²

1. Recall that, as used in this compendium, compliance is the process whereby existing pollution is halted or reduced or potential pollution is prevented. Voluntary compliance occurs when this process takes place without the formal legal sanctions of government being brought directly to bear.

2. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 195.

Furthermore, and as emphasized in the following chapter, no air pollution control agency has the resources to prosecute more than a small fraction of polluters. Consequently, air pollution control programs must rely primarily upon the voluntary acquiescence by polluters, and not upon the formal legal sanctions of pollution control agencies.¹

Air pollution control agencies can encourage voluntary compliance in two ways: (1) through techniques such as education, persuasion and negotiation with polluters, and (2) through approaches such as emission standards, land use controls, economic incentives and so forth. As reviewed in the chapter, some of the former techniques are more effective than others (e.g., threats of legislation or litigation). However, generally speaking, this category of techniques is usually not effective by itself in achieving air pollution control. Consequently, other more coercive measures (e.g., the emission standards approach) are necessary to motivate voluntary compliance by industry. These approaches are the subject of succeeding chapters in this compendium.

1. As emphasized earlier in this chapter, however, the pressure that a governmental agency can bring to bear upon industry is probably the single most important factor in motivating voluntary compliance by the private sector. Part of this pressure may depend upon the success of the control agency in bringing a limited number of polluters to court or getting stringent legislation passed by state legislatures.

CHAPTER 3

EMISSION STANDARDS

Enforcement of emission standards is the prevailing approach to air pollution control in the United States today.¹ Emission standards can vary considerably in complexity and scope, but in the main they prescribe how much of what kind of pollutant may be allowed from any given source (e.g., no power plant may emit more than X pounds of sulfur oxides per million BTU of heat input).² Probably the most common emission standard (and also one of the simplest to apply) is that which prohibits dense smoke emissions (analyzed by inspectors using the Ringelmann smoke chart). Somewhat akin to Ringelmann requirements are gas concentration standards that specify a maximum allowable percentage or weight-rate of a given pollutant to be emitted. For particulate matter, most emission standards are in the form of schedules limiting emissions as a function of the size of the operation; often, these standards place an absolute limit on allowable emissions as well.

1. To emphasize the distinctive nature of this approach, the terminology "emission standards" was deemed more exact than "direct regulation." The latter usually refers to a combination of measures which can include licenses, permits, registration and so forth. These measures, however, are really administrative arrangements which can be used in almost any approach to air pollution control. And, as applied under the emission standards approach, these measures are no better than the emission standards they implement. For discussion of a system employing emission standards, licensing and permits, see Chapter 9.

2. A further classification and discussion of emission standards is contained in Anthony B. Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources" (unpublished Ph.D. dissertation, Columbia University, New York, 1970).

For purposes of analysis, it is useful to separate the enforcement of emission standards into three sequential stages: (1) the establishment of emission standards; (2) the compliance period (including the possibility of variances, exemptions, and non-compliance leading to the third stage); and (3) the legal prosecution of those who violate the emission standards.¹ In actuality, of course, the stages are not necessarily discrete, and they may merge and overlap in time. It is important to distinguish among them, however, if an accurate assessment of the emission standards approach is to be possible.

Perhaps because legal prosecution is the ultimate sanction of any pollution control agency, most attention in the literature reviewed for this study seems to have been addressed to this, the final stage. The formal legal sanctions of the emission standards approach--sanctions which can range from admonishments with inconsequential fines to extended court action involving adverse publicity and stiff penalties for polluters--have been extensively analyzed. Moreover, many commentators seem to have assumed that the primary purpose in enforcing emission standards is to bring polluters to court.

As emphasized in Chapter 2, however, the enforcement of emission standards--like the enforcement of all laws and standards--

1. Monitoring air quality and emissions is another step which is basic to any control program, but one which ideally should extend throughout the enforcement process. See below, "Monitoring."

depends upon a high degree of voluntary compliance. As one authority has recently pointed out:

Air pollution control agencies, whether they be Federal, state or local, are forced to recognize that legal proceedings against individual polluters can never be the chief goal of a compliance program. Formal hearings and court action consume an extraordinary amount of time and manpower. The St. Joseph case, where the pollution had still not been controlled twelve years after the initiation of enforcement action, illustrates how long it can take to force compliance through legal action. Furthermore, the courts are not experts on pollution and the outcome of a court case is always somewhat unpredictable. Once a case goes to the courts, the final decision is no longer in the hands of the pollution control agency. All available experience indicates that laws against pollution, like all other laws, must rest primarily upon voluntary action if their purpose is to be achieved. In addition, no agency has the resources to prosecute¹ more than a small fraction of the polluters.

Obviously, as discussed previously, the extent of voluntary compliance will depend in some degree upon the success of the control agency in enforcing formal legal sanctions. But it must be recognized

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 185. The case, involving pollution of the Missouri River by the City of St. Joseph, Missouri, was brought by the Federal Government in 1957 under provisions of the 1956 Water Pollution Control Act.

that legal prosecution will probably never be the primary means of pollution control.¹ At least for the coming 5-10 years most pollution control agencies will rely more on techniques such as threats, persuasion, bargaining and negotiation, assistance and advice and education than on formal legal sanctions to achieve compliance with emission standards.²

For these reasons the present chapter concentrates on the crucial first and second stages of the emission standards approach. An accurate assessment of this approach entails a prediction of the problems in establishing emission standards and the problems of compliance. "Prediction" is used advisedly here, since somewhat surprisingly there has been little evaluation of these two steps in the enforcement of emission standards, even though this is the prevailing approach. The state of present discussion can be appreciated

1. In a similar vein, it has been argued that the prosecution of individual polluters should be avoided as much as possible. For example, based upon an extensive examination of enforcement efforts in Los Angeles and New York, one authority concludes:

The limitations of both legal and technical staff resources, the difficulty of resolving highly uncertain technical issues in an adversary proceeding and the administrative costs involved all point to the need for minimizing the use of litigation wherever possible.

Cf. George H. Hagevik, Decision-Making in Air Pollution Control: A Review of Theory and Practice, with Emphasis on Selected Los Angeles and New York City Management Experiences. (New York: Praeger, 1970) pp. 185-186. For a detailed discussion of the problems of legal prosecution before either judicial or administrative bodies, see Chapter 5 of this compendium.

2. Cf. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 177.

perhaps best by a brief review of some of the major advantages of the emission standards approach.

Major Advantages of Emission Standards

A major advantage claimed for the emission standards approach is that air pollution control agencies can attempt to control pollution even in the face of imperfect information on actual emissions. Where air pollution is a serious and obvious problem (e.g., people's eyes are burning because of smoke from a major industrial plant), it is possible to impose emission standards, "even if ways of measuring the plant's contribution to over-all levels of pollution in the air were not considered accurate, and even if the detailed effect of these over-all levels on health could not be specified."¹

Given the imperfect information and uncertainty attaching to air pollution control, this is an important advantage.² Where air pollution is too serious and obvious a problem to be denied, the imposition of emission standards is probably the major way to get polluters on the road to control. The very visible nature of smoke pollution, for instance, makes the lack of exact information on emissions less of a handicap. Thus, the early efforts at control in this country were concerned almost exclusively with smoke. Los Angeles

1. George H. Hagevik, Decision-Making in Air Pollution Control (New York: Praeger, 1970), p. 61.

2. Obviously, if emissions could be easily monitored (e.g., by in-stack devices) and if the dispersion of air pollutants could be accurately predicted, considerations of imperfect information and uncertainty would be central. But emission monitoring is complex and costly and the dispersion of pollutants in the ambient air is not well understood.

was one community which achieved considerable success in reducing this problem. The Los Angeles air pollution control program is also typical of the evolution of air pollution control effects from exclusive concern with obvious pollutants to the focus on invisible and odorless substances today. At the same time, however, it must be recognized that smoke was only the most obvious--and hence the first--concern of air pollution control.

In Los Angeles as of the late 1940's, according to one case study, initial control efforts were concerned with smoke, dust and fumes from "metallurgical plants, rock crushing operations, asphalt and paving processes, the food, paint, fertilizer and soap industries, the thousands of orchard heaters used to prevent frost damage, and diesel trucks and buses." By the early 1950's, the problem of black smoke and soot in the Los Angeles area had been virtually eliminated. The limited nature of this accomplishment was soon recognized, however, when "it became apparent that there was a serious problem associated with gasoline vapors in that eye irritation and crop damage are caused largely by the oxidation of these vapors to form photochemical smog." This recognition, of course, was the result of the discovery by Dr. Arie Haagen-Smit in 1951 that the automobile was the major contributor to Los Angeles'

smog. Previously, it was thought that smog was caused primarily by sulfur dioxide from stationary sources with assistance from smoke and dust.¹

Where pollution is less obvious, however (e.g., with odorless, invisible substances²), the above advantage (i.e. ability to apply emission standards in the face of imperfect information and uncertainty) is correspondingly less so. Pollution which can be concealed from view is another case in point.³ For these less obvious pollution problems, some sort of emission inventorying,

1. The increasing concern with invisible and odorless substances has continued even to today. In a May 12, 1971, press conference, the editors of Clear Creek, a California magazine on the environment, said that an unreleased Federal Government report showed that lead in the air around Los Angeles had risen from an average of 2.29 micrograms per cubic meter in 1961-62 to 3.58 micrograms per cubic meter in 1968-69. The California Health Department has set a safety standard of 1.5 micrograms per cubic meter. Cf. Bureau of National Affairs, Environment Reporter, Washington, D.C., May 21, 1971, p. 78.

2. Obvious pollutants, such as tiny particles of dust from the streets and soot from incinerators, residential furnaces and industrial smokestacks can be among the least dangerous to health. On the other hand, organic and nonorganic vapors, most of which are invisible, are frequently highly toxic when present in even small concentrations. Airborne particles in the sub-micron size range are in general not reported, yet they probably are of greatest danger due to prolonged lifetime before condensation, coagulation and settling. Smaller, less visible, but more hazardous particles include asbestos fibers (linked to chronic lung disease and cancer) and lead (which may injure the central nervous system).

3. For example, many chemical companies can regulate their production so that major emissions occur primarily at night, when they are much less susceptible to view. Municipal incinerators are another example.

inspection at the source or even emission monitoring will be required to determine what sources should abate where, and by how much.

More generally, it should be stressed that merely to impose emission standards does not guarantee compliance on the part of polluters. Eventually, therefore, the monitoring of emissions--whether by spot checks or on a continuous basis--is required under an emission standards approach, if only to check on compliance. This much appears recognized in the inspections, monitoring and entry requirements of the 1970 Amendments to the Clean Air Act.¹ The argument that emissions standards offer advantages in that they can be imposed with very imperfect emissions information, therefore, would appear valid only where pollution is obvious and then only in the short run.

A similar argument has been advanced as to the advantage of emission standards where data on pollution damages are inadequate. This argument:

. . . finds support in a recent staff report of the Committee on Public Works of the U.S. Senate, which states: "Whatever yardsticks are employed, it is clearly evident that the cost of property damages alone from air pollution is great--far greater than the amounts devoted to its abatement by industry and all levels of government." The implication of this often-heard argument seems to be that there is little chance of the costs of [an emission standards program] exceeding the benefits.²

1. See Chapter 1, "Inspections, Monitoring, and Entry."

2. George H. Hagevik, Decision-Making in Air Pollution Control (New York: Praeger, 1970), p. 61.

Whether this reasoning is valid in the long run is questionable, given increases in population, economic activity and public demands for clean air. In any event, there are several reasons why any approach to air pollution control should be based on a continuing evaluation of control costs, and when costs are considered it appears that emission standards are much more expensive than other approaches to air pollution control (see below, "Problems of Establishing Emission Standards").

A third argument sometimes asserted is that the emission standards approach is "considered to be equitable, at least superficially, in that all polluters must comply with the same regulation even though the costs they would face might vary significantly."¹ Given the fact that most polluters are more interested in how much they must pay than in how much they must not pollute, however, this argument is also very much open to question, and will be returned to below (see, "Avoidance of Enforcement").

A final--and probably the most important--argument advanced for emission standards concerns their alleged effectiveness and ease of administration. Aside from vague references to existing experience, however, no one in the literature reviewed for this study has supported such statements with empirical evidence or substantial argumentation. Such statements are also less than compelling when advanced without comparison to other approaches to air pollution control.

1. George H. Hagevik, Decision-Making in Air Pollution Control (New York: Praeger, 1970), p. 61.

Given the above, one is left with an uncomfortable paradox. On the one hand, the enforcement of emission standards is the prevailing approach to air pollution control in the United States today. On the other hand, little has been written to attest to the effectiveness and ease of administration of this approach, much less its comparative advantage to other possible supplementary and complementary approaches to air pollution control. Since this approach is the prevailing experience, however, perhaps there are more advantages to emission standards than have been acknowledged heretofore in the literature, advantages not specifically related to air pollution control, per se, but which rest more broadly on the "rule of law." It may be that emission standards should be viewed in a larger context, in which members of society pursue and realize values in an orderly manner. Perhaps the effect of establishing emission standards is to set norms for behavior with which most members of society are satisfied and willing to acquiesce. If these suppositions are accurate, there may be far greater voluntary compliance with emission standards--and thus more advantages to the approach--than are immediately apparent. We will return to this consideration in the concluding section of this chapter, after a more detailed review of the problems in establishing emission standards and the problems at the compliance stage.

Problems of Establishing Emission Standards

As discussed in Chapter 1, the overall objective of air pollution control is presumably to attain the prescribed ambient air quality standards. The establishment of emission standards constitutes one approach to this objective. Emission standards set forth the basis for actions to be taken by polluters.¹ They may also be an indirect means of measuring the progress of a program of pollution control.²

Air Quality and Emission Standards

The correspondence between air quality standards (i.e. pollutant concentrations in the atmosphere) and emission standards (i.e. emission concentrations from a particular stationary source) is a complex relationship which at present is imperfectly understood. For any given area, it will depend upon the topographical and meteorological conditions of the particular region, the diffusion characteristics of the particular pollutants involved, the synergistic combinations of those pollutants in the atmosphere, and

1. In the examples given at the beginning of this chapter, emission standards prescribed allowable emissions but did not specify what control methods had to be applied. Some emission standards, however, are tied to present good practice, e.g., application of the "best practicable means" standard applied in the New South Wales system (see Chapter 9) is a good example.

2. In a static system (i.e., an unchanging number of polluters, constant meteorological conditions and uniform economic activity with no mobile sources of pollution) compliance with emission standards would be a direct measure of progress. Such assumptions, of course, are not a very close approximation to reality.

the varying proportion of pollution from mobile, as distinguished from stationary, sources.

Because the transition from ambient air quality standards to emission standards is an extremely difficult task in practice, some air pollution control agencies make little or no attempt to relate the two in administering their control programs.

As noted by Arthur C. Stern, "Very little work has been done in relating emission limits for multiple sources of varied categories to air quality standards. . .innovation will be required." The State of New Jersey, for example, has both air quality standards and emission control requirements; the relationship between the two is, however, left entirely unspecified and no remedy is specified should air quality degenerate below the prescribed standards. Other authorities do provide for some relationships between emission control and quality standards. San Francisco provided for less stringent standards of emission control where air quality exceeds certain standards, while Pennsylvania and Allegheny County both give the air pollution control authority the power to specify additional requirements for the control of air pollution, especially on individual emitters, should air quality degenerate to a level below the prescribed standards. In general, however, no systematic relationships between emission standards and emission control requirements exist.¹

Questionable Assumptions

Even where emission standards are derived from the degree of improvement needed to attain ambient air standards, there are

1. Arthur C. Stern, Ed., "Air Pollution Standards," Air Pollution, Vol. 3, p. 620. Cited in Anthony B. Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources," (unpublished Ph.D. dissertation, Columbia University, New York, 1970).

assumptions involved which are by no means automatic. "The basic step is generally to calculate the percentage reduction necessary to get from existing levels to the quality standards and then to apply this same percentage reduction to existing emissions."¹

One assumption open to question concerns marginal costs. To apply the same percentage reduction to existing emissions is to

1. J. Clarence Davies, III The Politics of Pollution (New York: Pegasus, 1970), p. 156. To take an actual example, the Federal Government's recommended sulfur standard for New York City in the late 1960's was derived as follows:

The desirable level of quality for ambient air was set at an annual mean concentration of sulfur dioxide no greater than 0.02 parts per million. This was the least level associated with increased respiratory disease death rates in man, with significant corrosion of metals, and with injury to perennial vegetation. It was determined that in New York the existing concentration of sulfur dioxide in the air needed to be reduced by 83 percent to achieve the desired level. The total amount of sulfur dioxide emitted annually into the New York atmosphere (1,600,000 tons) was then divided by the total heat content of all coal and oil burned annually in the city (1,600 trillion British thermal units (BTU)) resulting in the figure of 2 pounds of sulfur dioxide per 1 million BTU. If an 83 percent reduction was to be achieved, then only 17 percent of the existing emissions could be allowed to continue. Seventeen percent of 2 pounds of sulfur dioxide per 1 million BTU is 0.34 pounds of sulfur dioxide per million BTU which, with slight rounding, was the emission standard announced for the New York area.

In practice, this emission standard was generally translated into a limitation on the sulfur content of coal. Multiplying the emission standard by 13,000 (an average pound of coal contains 13,000 BTU) and then dividing by 2 (one pound of sulfur will produce 2 pounds of sulfur dioxide), one arrives at a limit of 0.2 percent on the sulfur content of coal.

ignore differences in the marginal costs of control among various polluters.¹ Such a requirement for a uniform, across-the-board reduction in emissions can cost many times more than the application of selective abatement to meet the same control objective. Thus, for example, if one assumes two sources with equal emissions but different marginal costs of control, it would probably be much less expensive to society for one to abate by 80 percent and the other by 40 percent than for both to reduce emissions by 60 percent. This is the conclusion of several studies which have analyzed the costs for air and water pollution control.²

1. Non-uniform standards can take differing marginal costs of control into account, but only in a crude way. See below, "Difficulties in Determining Costs."

2. In a 1966 study of the Delaware River estuary, it was found that if across-the-board reductions were required, the cost of control would be increased by 50 percent over the selective abatement strategy. Cited in Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives. (Revised) "Cost Sharing with Industry?" Washington, D.C., 1971. (Mimeographed.) p. 19.

In 1967, a simulation study by the Department of Health, Education and Welfare showed that for certain types of air pollution control objectives an across-the-board reduction may be far more expensive than a selective reduction of emissions. "For example, to reduce the highest average annual concentration in the model city by 60 percent, . . . the equal proportional strategy costs almost three times as much as the least cost strategy (\$12,743,000 versus \$4,520,000)." Cf. U.S. Department of Health, Education and Welfare. Office of the Assistant Secretary for Planning and Evaluation. An Economic Analysis of the Control of Sulfur Oxides Air Pollution (Mimeographed: December 1967) p. I-4.

Three years later similar findings resulted from a study for the Department of HEW which continued the development of cost-effectiveness techniques which had been initiated for the above-cited 1967 study. The 1970 study extended the analysis of air pollution control in a "model city" of approximately 2 million to the actual data for the Washington, D.C. metropolitan area. Three strategies for areawide abatement of sulfur oxides and particulate

An across-the-board reduction through uniform emission standards would also ignore other important considerations including:

the location of the emission sources, meteorological conditions. . .and other factors which influence the dispersion of the pollution. It does not consider changes in the amount of pollution which will occur in future years because of industrial expansion, plant relocation, or other factors. Alternatives to emission reduction, such as. . .relocation of power plants. . .are usually not taken into account.¹

In short, the across-the-board reduction accomplished by uniform emission standards involves a number of simplifying assumptions, any of which when considered carefully would indicate the strong desirability of investigating other possible approaches. Non-uniform standards are one possibility under the emission standards approach. Such standards, which could be administered so as to

matter were simulated in this study: (1) a selective reduction strategy which achieves the selected air quality standards at least cost to the Washington, D.C. area; (2) a strategy relying on the restriction of fossil fuels to 1 percent sulfur by weight or less for the same selected air quality; and (3) an across-the-board abatement strategy for the same air quality level. For the highest reduction in peak annual average concentrations considered in the study, the selective reduction strategy cost \$5.3 million as against \$32.7 million for an across-the-board abatement strategy. The strategy relying on the restriction of fossil fuels could not reach the required reduction at all. Cf. Ernst and Ernst, Applications of Cost-Effectiveness Analysis to Air Pollution Control, prepared for U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service (Washington, D.C.: April 1970) p. IV-16 ff.

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 157.

vary according to the technical economic feasibility of applying standards, the social and economic value of the activity involved, the danger to public health and safety and other factors, would probably be less costly to society. However, non-uniform emission standards would be seen by many polluters as inequitable¹ and would probably be much more difficult to administer (see below) than uniform standards.

Difficulties in Determining Costs²

Any approach to pollution control should be based on a continuing evaluation of control costs. For one thing, this consideration is explicitly mandated by Congress.³ In addition, the

1. Under non-uniform standards, the apparent inequity of applying differing standards to all competitors in an area would be difficult to dispel. Perhaps non-uniform standards could be tied to prevailing good practice, e.g., installation of the best control devices which were commercially proven and available. This approach, however, would raise similar difficulties of administration as discussed below under "Difficulties of Determining Costs."

2. The present section is concerned primarily with the problems of determining costs for non-uniform emission standards. Implicit in the discussion is the difficulty of administering non-uniform standards, a problem which is treated explicitly under "Variances and Exemptions," below.

3. Section 108(b)(1) of the Clean Air Act, as amended, provides, "Simultaneously with the issuance of criteria under subsection (a), the Administrator shall, after consultation with appropriate advisory committees and Federal departments and agencies, issue to the States and appropriate air pollution control agencies information on air pollution control techniques, which information shall include data relating to the technology and costs of emission control. Such information shall include such data as are available on available technology and alternative methods of prevention and control of air pollution. Such information shall also include data on alternative fuels, processes, and operating methods which will result in elimination or significant reduction of emissions."

degree of compliance on the part of polluters will depend to some degree upon the ability of the control agency to speak authoritatively about costs. When a polluter is faced with public pressure for abatement, and it is recognized that pollution control officials speak with some knowledge of his operation and the overall costs of control which would be involved, then the stage is set for abatement.¹

Some air pollution control officials and representatives of public interest groups have argued that questions of cost should not be a central consideration in the administration of air pollution control programs. The reasoning for this conclusion seems to be (1) that air pollution abatement costs are a small proportion of gross national product (or other measures of income)² and (2) that the benefits from air pollution abatement are very high compared with all available estimates of abatement costs.

It does not follow, however, that obtaining air pollution abatement in an expensive manner is as desirable as obtaining the same abatement at a substantially lower cost. For one thing, the

1. See Carl G. Beard, II, "Improving Existing State Air Pollution Control Programs," The Third National Conference on Air Pollution, Washington, D.C., Proceedings (U.S. Public Health Service, 1966), p. 376. The importance of government expertise concerning methods of control and their costs is also emphasized in connection with the New South Wales System, "Government Technical Expertise," Chapter 9.

2. The Environmental Protection Agency estimates that the cost of air pollution control in 1976 will be at the rate of over \$6 billion annually, or about .5 percent of GNP. See, The Economics of Clean Air, Report of the Administrator of EPA to the U.S. Congress (Government Printing Office: March 1971) pp. 3-21 and 4-3.

comparison of air pollution abatement costs with total GNP ignores the probable impact of abatement expenditures on the nation's economy. In this connection, abatement costs should be compared not with total GNP, but with the increment of GNP expected in coming years. If, for example, the cost of air pollution abatement is about \$6 billion annually, the relevant comparison would be with the annual yearly real increment of \$25-30 billion in GNP, not the total GNP. Seen in this light, considerations of cost are much more central. Furthermore, air pollution abatement expenditures will most certainly distort expenditures in other areas of the economy.¹ Expenditures on air pollution abatement, in other words, can only come at the expense of other (also desirable) goals.

1. For assessment of the impact of expenditures for environmental control on the economy in the coming decade, see Andrew F. Brimmer, "Economic Impact of Pollution Abatement," Commencement Speech, University of Miami, (June 6, 1971). On the basis of an econometric study on the economy over the coming decade, Brimmer notes (p. 16) that, in terms of real expenditure, "the increase in producers' durable investment for pollution control was purchased at the cost of slight reductions in expenditures for plant and residential housing, and sizable drops in personal consumption and total GNP." The drop in GNP comes even though the initial investment pollution abatement is counted in GNP. The reason is that such expenditures are "non-productive" and unlike other investments will not pay off in more goods (and government services through the tax mechanism).

Under the emission standards approach, the determination of control costs for individual polluters is usually extremely difficult.¹ Where non-uniform standards are to be imposed, the administrator has to know the control potential of each source and must be able to manipulate all of these figures in order to arrive at a least-cost combination. The more sources there are, the more difficult to determine the appropriate mix. And most air pollution problems involve a very large number of sources. Generally speaking the result is that even a great deal of work on the part of administrators will not result in very accurate predictions of relative costs, or recommendations for action.²

1. Emission standards can sometimes take differing marginal costs of control into account, but only very crudely. For example, the New York-New Jersey metropolitan area abatement conference recommendations for sulfur oxides recognized cost and supply differences among sources--as well as the relative ground-level contributions from different source categories. The recommendations applied only to residential and commercial sources, which were low-level emission points. Power plants were permitted to burn 1 percent sulfur content fuel.

2. A very comprehensive study of costs incurred in air pollution control was recently prepared by the Federal Government. While a great deal of work and research was involved, the results can be taken only as very rough estimates of the true costs (the report considers average costs of firms in the various industries--true costs of individual plants would be almost impossible to obtain.) Second Report of the Secretary of HEW to Congress of the United States, The Cost of Clean Air. (Washington, D.C.: Government Printing Office, March, 1970). The third report on the costs involved in air pollution control was submitted to Congress in April of 1971 as Economics of Clean Air. However, since this report was prepared prior to the enactment of the 1970 Clean Air Amendments, its nationwide projections are already out of date.

The problems associated with determining control costs tend to increase in difficulty exponentially with the number of sources--and the variations within classes of sources--involved. It may be relatively easy to choose the emission reduction required for a class of firms (e.g. gray iron foundaries). Much more difficult is the decision about how to apportion the overall abatement requirement for the class of firms among individual polluters.

This is a particular problem for air pollution control. Achieving the desired quality of ambient air--and thus controlling emissions from an entire class of polluters--is a far different problem from seemingly similar areas of government regulation such as the regulation of drugs by the Food and Drug Administration. In the latter case the number of drug producers is usually small, and an inappropriate action on the part of any one of them could lead to very serious results. In air pollution control, the number of polluters is usually very large and the problem is less to control each individual polluter than to see that overall emissions are reduced. If standards are applied across-the-board, then the result is clearly inefficient--far more is expended to achieve a given reduction in overall emissions than need be. However, if non-uniform emission standards are applied (i.e., on a plant-by-plant basis), then the difficulties of determining control costs become enormous.

One source of information on control costs is the producers of pollution control equipment. Data from these sources, however, tend to relate more to capital than to maintenance costs and to disregard the costs arising from disruptions in production, the potential loss in sales and share of the market during down times, and so forth. Furthermore, producers of pollution control equipment may tend to overstate the degree of control their equipment can provide.

Another source of information on control costs may be the polluters themselves. The difficulties in obtaining reliable cost of control data from polluters, however, can be complex, as attested by the director of one state air pollution control agency:

The cost of a control device is difficult to obtain since it varies from plant to plant and area to area. The first cry of the polluter is that it costs too much. He would like to settle for less restrictive and also less costly control devices. He will tell you that the cost of the control device, when added to his other costs of production, will make his products noncompetitive, both with those of other companies and of other plants within his own corporation. Basic raw materials and power costs, nearness to market of product, labor costs, means of transportation, age of the plant, costs of financing, and other factors, make an inter-related financial jungle. All of these may be named by the polluter to support his case. He will also remind you that money being spent for control devices would earn a better rate of return if invested in production equipment.

In order for any control agency to make any reasonable estimate of true costs, it would have to have a highly competent staff of cost accountants and expert legal advice on corporate structure as well as having access to the polluters' books.¹

A disadvantage of non-uniform emission standards, therefore, is that this approach requires more information on control costs than do some other approaches (as well as more information than most administrators have). Under the emission charges approach, for example, each polluter determines the appropriate level of abatement and the appropriate method of control in light of the charge which is imposed. With this approach, much of the burden of determining control costs and taking appropriate action is shifted from the public to the private sector.² Furthermore, it is argued that once polluters are confronted with a charge they are in a better position than public officials to evaluate the technical merits of alternative methods of control because of their more intimate knowledge of their firm's operations. The application of non-uniform emission standards would require a duplication of this

1. Carl G. Beard, II, "Improving Existing State Air Pollution Control Programs", The Third National Conference on Air Pollution, Washington, D.C., Proceedings (U.S. Public Health Service, 1966), p. 376.

2. An emission charge system, however, could require more time to implement than an emission standard approach since the polluter could decide to pay the charge, postpone abatement and wait for the development of new control technology.

effort; not only would polluters have to consider control costs, but so would the pollution control agency.¹

The Problems of Compliance

Compliance with emission standards depends on a large number of factors in both the public and private sectors. The responsibilities of federal, state and local air pollution control agencies--and the consequent requirement for intergovernmental cooperation--were identified in Chapter 1. As indicated in Chapter 2, much will depend upon the competence and administrative capabilities of these agencies and the way in which they exercise both their formal controls and their informal contacts and communication--consisting of bargaining and negotiation, influence, assistance and advice. The latter must be developed intensively--both among various levels of government with complementary pollution control responsibilities and between air pollution control agencies and the private sector.

Cooperation from the private sector is also required, particularly given the large number of firms which must be controlled and the necessary dependence of emission standards on voluntary compliance. The major ways in which government can encourage

1. In this regard, the difference between the standards and the charges approach is one of degree--not of kind. Both approaches require information on control costs, indeed, and the requirement for a continuing evaluation of control costs is mandated by federal legislation (although this is not binding on states and localities). However, non-uniform standards generally require more information on a firm-by-firm basis. This is a relative disadvantage to the extent that, for any given class of polluters, the control costs have wide variance and consequently are difficult to ascertain.

voluntary compliance with pollution control measures, in general, were discussed in Chapter 2. Here, attention is addressed to several problems of compliance which arise specifically from reliance upon emission standards as a major approach to air pollution control.

Monitoring

A crucial step in any pollution control program is the inventorying of sources and the monitoring of emissions. For most pollution control problems the latter is essential--both as the basis for determining where and what emission standards should be set and for determining the extent of compliance once standards have been imposed.

Very few air quality control regions, however, have completed emission inventories and most polluters have historically had little incentive to install or operate monitoring equipment. This may change under the inspections, monitoring and entry requirements of the 1970 Clean Air Amendments (see above, Chapter 1). Nevertheless, financial incentives and/or vigorous enforcement backed by stiff penalties will probably be needed if the installation of monitoring equipment and the maintenance of emission records is to become a widespread practice among private sector polluters.

Even if emission monitoring is undertaken, continuing incentives exist for polluters to mislead officials under the emission standards approach. Examples of such practices are provided in a recent account of air pollution control efforts in Chicago, where it is claimed that local steel companies have consistently attempted to

deceive public officials about their abatement activities.¹ According to this account, when Chicago first passed an air pollution control ordinance in 1958, the steel companies were exempted. In 1963, however, the law was revised to include the steel companies. At that time, the steel companies obtained an eight-year variance on the grounds that it would take that long for their plants to comply with the law. But as evidence of their good faith the companies proposed and agreed to an abatement schedule, whereby particulate emissions would be progressively reduced.

Subsequently, the steel companies submitted their annual progress reports, which indicated that the abatement schedule was being adhered to. By January 1969, emissions were to have been reduced by 85 percent of the 1963 figure. But day-to-day observation did not support the optimism of the steel companies' progress reports (a Chicago air pollution control official told the Chicago Daily News in May of 1969: "I can't tell a woman on the South Side who hangs her wash that they have controlled 85 percent of their smoke pollution. . . It looks and smells like an outhouse out there."). Furthermore, the City Department of Air Pollution determined by 1969 that, rather than having reduced their emissions, two of the major polluters on the South Side had actually increased their total dust output by approximately 2,000 tons per year apiece.

1. John C. Esposito, Vanishing Air (New York: Grossman Publishers, 1970), p. 82-85.

2. Ibid., p. 83.

Critics of the pollution control efforts by Chicago steel companies have explained the apparent contradiction in three ways. First, it was claimed that the companies intentionally overstated the extent of emissions in 1963 so as to be able to exaggerate the progress being made. Predicted progress was based on the reduction of potential emissions, i.e., the overall pollution that would be produced if all equipment were in full operation. But as of 1963, when the predictions were made, not all the existing equipment was fully operative, a fact not mentioned to the City Department of Air Pollution. Second, it was claimed that the companies did not report pollution control progress accurately. And third, it was claimed that the companies prepared joint progress reports so as to conceal deliberately the inadequate performance of some individual firms. According to this account, it was not until 1969 that Chicago's Department of Air Resources was able to unravel the mass of aggregate figures submitted in joint reports from the steel companies. "Thus, another standard device for polluters is to submit to control officials aggregate data, thereby covering up inadequacies of individual performance and avoiding 'harmful' competition. . . in the reluctant race to clean up."¹

1. John C. Esposito, Vanishing Air (New York: Grossman Publishers, 1970) pp. 83-84. This may or may not be a desirable manner of reporting, depending on the objectives of the air pollution control program. If the objective is to reduce aggregate emissions, the inadequacies of individual firms are of little importance as long as overall emissions are reduced by the desired degree. If the objective is to reduce localized concentrations of pollution, however, it may be necessary to know the extent of emissions of each individual plant. The latter objective would also be particularly important where population concentrations are close to polluters or where even small amounts of pollutants would be extremely dangerous.

Incentives for polluters to mislead--by tampering with monitoring equipment, by falsifying emission reports, etc.--exist under other approaches to air pollution control. However these incentives are stronger under emission standards because the sanctions of this approach are non-incremental, i.e. there is a penalty (and under recent federal legislation a very high one) for emitting above the standard, but no penalty for emitting below. Thus, the motivation for firms under this approach is to show that their emissions do not exceed the specified standard. This can be attempted through various practices, for example, by requiring reports, specifying report formats, requiring periodic calibration of monitoring devices by the pollution control agency, and so forth.¹

The extent and seriousness of such practices is not now known, but it is reasonable to conclude that this problem is more significant under emission standards than under some other approaches. With emission charges, for example, the amount paid by the polluter increases with increasing amounts of pollution. Thus, although there would doubtless be some motivation to understate pollutant emissions, the incentive for doing so would be much less, since charges are incremental in nature rather than based on transgressing a specific threshold. Certainly, in the extreme, it would be difficult for any polluter to pretend that no pollution had been emitted at all.

1. Emission source monitoring systems are essential for any pollution control programs; but for specific reasons, this subject was not pursued at length in this report. See Chapter 10 "Information Requirements."

Vesting emission monitoring responsibilities in the air pollution control agency may provide part of the answer. Even so, such a system is not foolproof. According to recent testimony before the Senate Subcommittee on Air and Water Pollution, an inspector in one state habitually announced in advance when he would inspect companies, and each company, of course, made sure that it was not violating any standard on the day of inspection.¹ Misleading practices--extending as far as bribery and corruption--are inherent in any such system.

Variances and Exemptions

Any approach to air pollution control must take account of the competing interests involved. One source has listed the interest in air pollution control as follows: "(1) the public's need for clean air; (2) the need of industry, which emits air contaminants, to be able to operate efficiently and economically, and (3) the public's need in having industry continue to operate so that it may employ people, produce a particular product, and

1. Cited in John C. Esposito, Vanishing Air (New York: Grossman Publishers, 1970), p. 87.

stimulate the economy."¹ At the compliance stage, competing interests may be taken into account by a pollution control agency decision to grant a variance from the emission standard, to issue an order against those who violate the standards, or both.

In deciding whether to issue an order, a pollution control agency is often required by law to consider a number of factors:

"(1) the type of injury or interference with safety, health, or use of property which is caused or threatened; (2) the social and economic value of the activity involved; (3) the suitability of the activity to its location; and (4) the scientific and economic practicability of reducing or eliminating the discharge resulting from the activity."²

Competing interests may also be considered by the air pollution control agency in its decision as to whether or not a variance should be granted:

1. Richard A. Aborn and Carl E. Axelrod, "States' Air Pollution Control Legislation," Boston College Industrial and Commercial Law Review, Vol. 9 (Spring 1968), p. 738. Three ways of considering the competing interests are discussed in this article: (1) the requirement under some air pollution control legislation that before a standard can be adopted, notice must be given and a public hearing be held for all interested parties; (2) the establishment in some jurisdictions of a board or commission consisting of members from various interests: industry, the public, government and the medical and engineering professions; and (3) the provision in some statutes that the air pollution control agency or board mandatorily consider competing interests in promulgating standards, in enforcing them or at both times. Generally, the competing interests in air pollution control are given most consideration at the enforcement stage, which is the focus of attention for purposes of the present discussion.

2. Richard A. Aborn and Carl E. Axelrod, "States Air Pollution Control Legislation," Boston College Industrial and Commercial Law Review, Vol. 9 (Spring 1968), p. 749.

A variance is a statement by the administrative agency that it will not attempt to enforce a standard against an individual and that the individual will be allowed to discharge air contaminants for a longer period of time or to a greater extent than provided in the standard. The right to emit air contaminants under a variance is not usually unlimited, however. The variance will often require the individual to comply with a standard that is less rigid than the one contained in the applicable regulation or statute.²

It is unnecessary for purposes here to either discuss the legal aspects of each action or to describe the essential differences between enforcement and variance proceedings.¹ The point which has to be emphasized is simply that these two procedures represent the only ways of balancing interests at the enforcement stage of an emission standards approach as such. They suffer from two disadvantages.

A first disadvantage to variances and exemptions under the emission standards is that little continuing incentive is in existence for the eventual application of control. There are numerous examples of variances or exemptions being granted on the grounds that commercially proven technology is not available-- but with little evidence in the aftermath that industry is really attempting to develop the needed technology for control. Sulfur oxides pollution is an excellent example, where industry has little

1. Richard A. Aborn and Carl E. Axelrod, "States Air Pollution Control Legislation," Boston College Industrial and Commercial Law Review, Vol. 9 (Spring 1968), p. 752.

2. For a detailed discussion of this point, see op.cit., p. 753.

incentive to invest in control equipment until it has been tested for some time. In the meantime, the application of emission standards would be met with arguments from industry on technical feasibility. For such situations, other approaches, such as emission charges, could offer a powerful incentive for industry to demonstrate and use the developing technology as soon as possible to avoid the charge.

A second drawback of both variances and exemptions is the apparent advantage accorded to those polluters that are granted variances or exempted from enforcement orders. As emphasized earlier the attitude of industry toward complying with emission standards is heavily dependent upon the even-handedness of the pollution control agency.¹ Given the fact that most pollution control programs based on emission standards will stand in need of some variances and exemptions, and that these may be of an open-ended nature, the administration of emission standards could well take on an appearance of arbitrariness that would be difficult to dispel.²

This problem is probably less acute with some other approaches to air pollution control. For example, to grant a variance or to allow an exemption under the emission charge approach is

1. See the discussion "Clear and Consistent Public Administration" in Chapter 2.

2. The apparent inequity of this approach is a problem under both uniform and non-uniform emission standards. Under the former, the burden of abatement is distributed arbitrarily without regard for differing marginal costs of control. The latter raises the problem that some industries will conclude that all competitors in the area are not being treated alike.

completely contrary to the intent of the charge and thus could not be allowed. As the charge is considered for legal purposes as a tax, its collection would be subject to the constitutional requirement that all those taxed must be treated fairly.¹

Summary and Conclusions

Enforcement of emission standards is, for the most part, the job of state and local governments. As indicated in Chapter 1, short of special surveys on an area-by-area basis, it is difficult to say how states will respond to their increased air pollution control responsibilities. The extent to which states can and will aggressively pursue the enforcement of emission standards is primarily dependent upon how quickly states can obtain the necessary statutory authority and can develop the requisite technical expertise.

With regard to the latter, the technical tasks confronting states--most of which have not had significant experience in air pollution control activities previously--are of an extremely sophisticated nature. Each state must determine the relationships between ambient air standards and emission standards for its unique topography, meteorology, and spatial configuration of polluting sources. States must also become aware of the latest air pollution abatement equipment and become authoritative about the associated costs of imple-

1. The difference in the intent of emission standards leads to a difference in the way courts choose to handle variances and exemptions. An emission standard may be enforced as a criminal law. The pollution control agency prosecutes whichever violators it chooses, and the fact that other violators are not prosecuted is no defense.

mentation and operation. In addition, expertise must be developed in the use of state-of-the-art monitoring and surveillance techniques.

The effectiveness of the emission standards approach is thus dependent upon the pace of information transfer between federal and state and local air pollution agencies. Since two-way information transfer appears to be a crucial determinant of the prospect for realistic and effective programs of air pollution control, studies on improving this transfer should be a priority area for future research.

Some indication of how effective emission standards will be in controlling air pollution could be obtained by a survey of enforcement on an area-by-area basis. Of particular significance would be a detailed accounting on the prevalence of voluntary compliance, that is, compliance under emission standards short of pollution control agencies taking polluters to court.

Handicapped by the lack of case studies, the best that can be done is to pinpoint some of the likely problem areas and to suggest the kinds of problems for which enforcement by emission standards is more suitable than others. Suitable areas probably include cases where the pollution is obvious, cases where the number of sources is small or homogeneous (obviates the need to take into account differing marginal costs of control), and cases where pollutants--even in small amounts--are extremely dangerous. Radioactive

substances, perhaps, head the list of the latter; the hazardous substances already declared by the EPA Administrator under his new enforcement authority of the Clean Air Amendments of 1970 are others. In such cases, a complete ban on emissions may be needed, except where national security precludes, as provided for in 1970 act.¹

Despite the conceptual and operational problems associated with pollution control under an emission standards approach, it is, nevertheless, the prevailing experience. Such being the case, as suggested above, there are perhaps more advantages to emission standards than are acknowledged in the literature--advantages which rest on the "rule of law."

Emission standards, like all laws but especially those with a clear and widely shared moral basis, become effective insofar as they become internalized in the culture as "social norms." Emission standards may succeed by explicitly establishing strong expectations of behavior that society, as a whole, believes to be in its best interest. Compliance, then, may take place as part of a general cultural phenomenon--the process by which individual members of a society pursue and realize values. To understand the potential effectiveness and limits of emission standards acting as social norms, it is necessary to examine the process by which standards become authoritative, i.e., an effective prescription for action by

1. See discussion of "National Emission Standards for Hazardous Air Pollutants" (Sec. 112 of the Clean Air Act Amendments of 1970), p. 1-25.

polluters. This requires that standards be viewed in a larger context so that the interplay of many factors--social, economic, and cultural--can be carefully analyzed. Consideration need also be given to the institutional support with which standards are established, applied, and administered.

Detailed analyses along these lines of the process by which emission standards become effective social norms is beyond the scope of this report. However, certain significant dynamics of the process are quite clear and deserve attention. In this regard, perhaps the single most important factor underlying the potential efficacy of the standards approach is the changing nature of the "cultural climate" in which polluters must conduct their activities. The increasing concern with what EPA Administrator Ruckelshaus has called "the environmental ethic" may mark a major change in values, particularly when viewed in conjunction with the increasing concern for the "social responsibility" of the private sector. As indicated in Chapter 2, there is considerable evidence that business is becoming more and more concerned with its social role. It is the rare corporation today that doesn't have some sort of social program. Such programs run the gamut from minority training and housing rehabilitation to day care centers, medical services, and experiments in education. The significance of such programs from an air pollution control

standpoint is, of course, the indication that a new, more socially responsive ethic is developing to guide business behavior.¹

The shift in private sector values may essentially re-pattern the nature of the expectations both citizens and industrialists have as to what constitute "proper" activities. With respect to air pollution control, it is, hence, conceivable that fostered by supporting institutions, emission standards may become a benchmark for a standard of behavior that is both acceptable, and moreover expected. Should this, indeed, occur, some currently existing "attitudinal" obstacles to compliance would probably cease to frustrate future enforcement efforts. For example, polluters would have the consensual backing needed to take the control actions that they desired to, but previously could not otherwise justify to stockholders.²

1. Heretofore, it is probably a fair characterization to say that the majority of businessmen genuinely believed that it would be ethically wrong to do anything more than maximize profits. In this view, money spent by business on social reforms would either have to come from consumers in the form of higher prices or from the shareholders pockets--and in either case would constitute a "tax" that business is not entrusted to levy. The development by the private sector of a preponderance of social action programs--many of which cannot be expected to generate increases in business activity (a point often challenged by cynics of private industry)--probably indicates a decided shift in the attitudes of business about its social role.

2. Currently, businesses seeking to take socially responsible actions are hard pressed to find "justifications" for doing so. Indication of this difficulty can be deduced from the "economic" justifications currently offered. One typical theory holds that since shareholders' portfolios are widely diversified, each shareholder has a financial stake in improving the total society and consequently some of his profits may legitimately be used by management on social projects.

There are several important characteristics, however, which distinguish pollution control by emission standards from other areas where enforcement of laws has been effective in modifying social behavior on a large scale. First, the social norms are far less developed for air pollution control; the air pollution problem, as indicated earlier, has only come into national focus in the last four to five years. What is more, the legal basis for control has only recently been established and acceptable behavior is only beginning to be defined. The importance of these factors is emphasized by the experience with civil rights in this country. Civil rights legislation did, indeed, successfully create new social norms and modify behavioral expectations. But with civil rights, it was abundantly clear what constituted acceptable behavior and, furthermore, the legal underpinning for enforcement had been established long hence.

The difficulty in recognizing "acceptable" behavior further limits the possibilities of developing effective social norms as regards air pollution control. Many pollutants, of course, are invisible, odorless, and/or have long lead times before effects are evident.

Another distinguishing feature of air pollution control is that the decision process is very decentralized; there are a large number of private sector sources and there is no centralized technology for treating air, as there is in water pollution control.

As one authority points out, these features give industry a considerable amount of power to influence the pace and progress of enforcement:

The power of industry to foster or retard pollution control is tremendous. This derives not primarily from its political sophistication or monetary resources but from the simple fact that the ultimate decision whether or not to cease polluting lies with each individual firm. Government can set standards and can enforce them against particularly recalcitrant firms, but without widespread cooperation on the part of industry significant pollution abatement will not be achieved. Pollution laws, like all other laws, require a high degree of voluntary compliance for their success, and thus the private sector, considered collectively, has a veto power over the progress of most pollution abatement.¹

These considerations emphasize the possible limitations of emission standards acting as social norms. The implications they hold for successful control of air pollution under emissions standards cannot be determined without a more comprehensive analysis than has been possible in this survey. Furthermore, it is too early to ascertain the likely outcome of the complex interactions of the many factors that will determine the behavior of polluters under emission standards. Certainly, the inducement effect of standards will be correlated with the extent of crisis which is perceived. If the environment is seen as seriously threatened, e.g., substantial damages to public health and welfare, polluters are probably more likely to act.

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 91.

In addition to the possible development of an "environmental ethic" and the growing recognition of the general need for some pollution control, other factors outlined in Chapter 2 will play important roles in determining the extent of compliance under emission standards--the desire of industry not to offend the public; the desire not to incur various formal legal sanctions, (which under the 1970 Clean Air Act Amendments are very high); the extent of "clear and consistent public administration" (which also means the disadvantages of complying with emission standards will at least be reciprocal).

The possibility also exists, as explained previously, that polluters may accept emission standards not because they believe them to be desirable or tolerable, but rather because they lack the ability to change things. In this connection, however, economic considerations are extremely important; if emission standards are seen as weakening the firm's economic viability--which may not be uncommon because of the difficulties in maintaining equity--polluters are likely to apply more pressure to seek changes, or more likely, to not comply.

The difficulty in predicting the extent of compliance under an emissions standards approach is further compounded by the fact that industry is not monolithic with regard to pollution control: No group opposes pollution control per se, and as one expert indicates, there are even industries which encourage it:

. . . industry cannot be considered any more monolithic in relation to pollution control than it is in relation to any other major public issue. This point is underscored by the growing role of industries engaged in the manufacture of pollution control equipment. For firms which contribute to pollution, government regulation and the installation of control equipment is at best a necessary evil. However, for firms manufacturing control equipment, the more regulation the better. For example, while the automobile industry dragged its heels on the question of controlling pollution from motor vehicles, American Machine and Foundry and other potential manufacturers of after burner equipment were lobbying for more stringent regulations which, they hoped, could be met only by the installation of the additional equipment they would produce.¹

To conclude, the ability to predict compliance at this point is extremely limited. The degree of compliance with emission standards is the end product of a process with highly uncertain and imperfectly understood dynamics. The existence of uncertainty, plus a number of problems which would not be resolved even with compliance with emission standards (e.g., higher than necessary costs of control for uniform standards, difficulty of administering non-uniform standards, the apparent inequity of both approaches) suggest that as enforcement proceeds under the emission standards approach, attention be addressed as well to other approaches, as supplementary and/or failsafe measures.²

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 95.

2. See Chapter 10, "Conclusions and Directions for the Future."

CHAPTER 4

LAND USE CONTROLS

A basic solution to the air pollution problem, of course, would be simply to prohibit pollutants from getting into the air in the first place. Until the day when that objective is reached, however, a short-term measure would be to disperse existing pollutants as widely as possible. Two major land use controls are available to improve the dispersion of pollution from stationary sources: by planning and zoning the location of plants where the natural air flow will spread the pollutants; and by increasing stack heights so as to vent the emissions at a higher level in the atmosphere.

Planning and Zoning

In the past, locational decisions for industrial plants have usually been preceded by a very superficial environmental analysis, if any was made at all. Consequently, "neither the people who are building the plants nor the public at large has any real notion of what the results will be in terms of thermal, noise, water and air pollution."¹ A necessary first recognition, therefore, is that plant location can have an important impact on the environment. More specifically, the distribution and density of pollution sources are crucial factors in overall air quality.

1. Charles L. Hosler, "Air Pollution and Plant Location," Appalachia, Vol. 3, No. 9 (1970), p. 3.

Thus, an objective in achieving air quality might be to locate industrial plants where the pollution they produce can be widely dispersed.¹ In this way, planning and zoning controls can be used to effect more widespread dispersion of pollutants in the air.²

Horizontal dispersion alone, however, will not, by itself, really do the job. As one authority has recently pointed out, "genuine vertical dispersion of pollutants" is required in order to do more than simply transfer pollutants to people who live downwind:

In terms of solving our national pollution problem, it helps little to build a plant in a location where the wind will carry the pollution into the next county rather than letting it asphyxiate the local citizens. Such planning may dilute the pollution by spreading it over a wide area, and may thereby avoid acute air disasters, such as the one in Donora. But only planning which insures maximum vertical dispersion can

1. As noted in the following chapter on "Private Legal Action," the courts have for many years held that, in matters of air pollution, the local zoning ordinances are perhaps the most explicit manifestation of the community's interests and wishes. Likewise, defendants have often argued that their conformance with these requirements was evidence of the reasonableness of their activities. It bears repeating, however, that conformance with zoning requirements in and of itself does not relieve the polluter of liability.

2. See C. Peter Rydell and Gretchen Schwarz, "Air Pollution and Urban Form: A Review of Current Literature," Journal of the American Institute of Planners, Vol. 34 (March, 1968). In addition to the location of industrial plants to minimize pollution effects, the authors discuss the design of buildings and streets, the location of industrial sites, the transportation of people and goods, the allocation of open space, the planning of land use and the planning of air as measures to prevent and/or control air pollution in urban areas. For an excellent treatment of planning and zoning for water pollution control, see Sigurd Grava, Urban Planning Aspects of Water Pollution Control (New York: Columbia University Press, 1969).

make any real long-run dent in our regional and national air problem.¹

Broadly speaking, planning and zoning controls can be used either to relocate existing sources of pollutants or to affect the siting of future sources, for example by adopting zoning regulations.² Although most attention has focused upon preventive action, at least one simulation study concludes that the abatement of sulphur oxides achieved by relocating existing power plants could be substantial:

The abatement achieved by the relocation of the power plants is substantial and the annual costs of achieving abatement by this technique, under the assumptions set forth herein, indicate that it may be the least expensive technique for control of power plant emissions.³

1. Charles L. Hosler, "Air Pollution and Plant Location," Appalachia, Vol. 3, No. 9 (1970), p. 3. Dr. Hosler is dean of the College of Earth and Mineral Sciences, the Pennsylvania State University, and serves as an industrial consultant on problems of air and thermal pollution.

2. According to one authority, "The time and place to pollute air is downwind. . . To make the zoning work best, downwind land zones for air pollution should be subject to a substantial annual tax, to minimize underuse of and speculation in industrial sites, thereby enabling a small zone to support a large industrial base. Similarly, land protected from pollution should be subject to an annual tax to ensure that the sacrifices undergone to protect the land are not wasted on the desert air, so to speak." See Mason Gaffney, "Economic Analysis and Air Conservation" in Bulletin of the Atomic Scientists, May 1965.

3. Office of Assistant Secretary for Planning and Evaluation, U. S. Department of Health, Education and Welfare, "An Economic Analysis of the Control of Sulphur Oxides Air Pollution," (December, 1967), p. 111-113. The analysis continues, however: "Whether or not the technique would be applicable to all situations is a question which cannot be answered here. It should be noted that, while this [technique] works very well for the model city, it has merely moved the emission to another location, which may now be faced with the problem of control."

Nevertheless, if clean air is to be realized in the future, it is clear that the potential environmental impact of industrial location decisions must be anticipated in advance, instead of after the fact, when it may be either too late or too expensive to correct the problem.

Increasing public awareness of the need to protect the future environment has provided a receptive climate for a number of proposals to apply planning and zoning techniques to potential air pollution problems. Two principal proposals will be discussed here: the recent proposal by the Energy Policy Staff of the Office of Science and Technology for governmental control, chiefly at the state level, over the location of new electric power plants and extra-high voltage transmission lines; and the land-use planning provisions of the amendments to the Clean Air Act.

Electric Power and the Environment

The most recent proposal for planning and zoning controls over plant siting has come from the White House Office of Science and Technology. On October 3, 1970, Dr. Edward E. David, Jr., the newly appointed science advisor to the President, announced that, "very early in the next session," the Administration would send to Congress legislation providing for governmental control, chiefly at the state level, over the location of new electric power plants and extra-high voltage transmission lines. The purpose of the new

legislation, Dr. David said, would be, "to reconcile the need for electric power and the need to preserve our environment."¹

The rationale for the new legislation was provided by a study made public at the same press conference. The study, entitled "Electric Power and the Environment," was prepared by the Energy Policy Staff of the Office of Science and Technology.² New legislation is necessary, says the study, because of the unanticipated growth in electric power use and the impact of power plants, both fossil-fueled and nuclear, on the environment.

According to the report, electric power use in the United States has been doubling every ten years for several decades, and unless this rate of growth is slowed, electric power capacity may have to be tripled or quadrupled in the next twenty years. Because hydroelectric resources have largely been developed, steam power and nuclear plants must provide new growth.

The report pointed out, however, that fossil-fueled plants--both coal and oil--discharge almost 50 percent of sulphur oxide pollutants, 25 percent of particulate matter and about 25 percent of nitrogen oxide emissions in the United States. Furthermore, the heated water discharged by both fossil-fueled and nuclear plants can do great biological damage to aquatic life. The time has come, the

1. "U. S. to Ask Curbs on Power Plants in Pollution Step," New York Times, October 4, 1970, p. 1. Much of the following discussion draws heavily upon this lengthy article by E. W. Kenworth.

2. Electric Power and the Environment (Washington, D. C.: U. S. Government Printing Office, August 1970). See Annotated Bibliography, item 171, for further details.

report concluded, when these problems must be met by long-range planning by utilities "in which environmental concerns have been considered as an integral part of the planning process," and environmental protection has figured in the legitimate costs to be shared by the consumers.

Moreover, industry must share the planning responsibility with governmental agencies and the public, represented by environmental organizations. These governmental agencies would have the authority to issue certificates for the construction of plants and power lines, and to veto such construction if plans do not meet air (and other environmental) standards set by the Federal Government.

Briefly summarized, the legislation contemplated would require every electric utility to plan its expansion long in advance and to obtain approval of a public agency. Regional plans would have to be laid out ten to fifteen years in advance of facility construction. An "inventory of suitable alternative sites" would then be identified five years before the proposed start of construction so as to allow ample time for public hearings, discussion of alternative sites and so forth. For the most part, utilities would seek approval of their plans from state agencies, but if any state or region should fail to provide the requisite protection of the environment in this regard, the Federal Government would temporarily take over that responsibility.

More specifically, the Administration program and the machinery proposed for effecting it would work as follows:

1. There would be long-range planning by industry on a regional basis at least ten years ahead of construction.
2. At least five years before construction, an inventory of alternative plant sites and plans for power lines would be made public. Government environmental agencies would begin to participate in the planning, and environmental organizations and the public would have an opportunity to present their views.
3. Two years before the start of construction, companies would make public specific plans on plant sites, plant characteristics and power line routes. This, the report stated, would give government agencies time for detailed review.
4. State, or preferably regional, agencies would be established to do the reviewing of plans, and these agencies would certify that the plans complied with air and water quality standards and other environmental considerations imposed by both state and federal governments. The state or regional agency, the report said, "would have the authority to say 'yes, you are authorized to put it here,' as well as to say, 'no don't put it there.'"
5. The Federal Government, which licenses all nuclear and hydroelectric plants, already reviews their plans. But under the proposed legislation, plans for fossil-fueled plants would also be reviewed by Federal agencies concerned with environmental protection. The report said that, "the state or regional agency certifying such facilities should give due consideration to the comments of all these Federal agencies" on the impact of the plant and power lines on wetlands, wildlife, forests, recreation and public parks.
6. If the state or regional agency failed to exercise its responsibility for certifying that a plant met environmental protection requirements, then a Federal agency, to be established by the President, would assume the function.

1. "U. S. to Ask Curbs on Power Plants in Pollution Step," New York Times, October 4, 1970, p. 1. In addition to the above, the article states:

The report also recommended 'a greatly expanded' program of research and development by the Government and industry to develop techniques for utilizing or

One of the most constructive suggestions of the report is for the multiple use of right-of-way corridors, not only for utility lines but also for pipelines and possibly highways. From the standpoint of the electric power industry, perhaps the most heretical suggestion is the consideration given in Chapter VII to slowing the growth of electricity consumption. Another suggestion of note is to examine the price structure of industry to determine whether special peak power rates are warranted. Advertising which increases the demand for electricity also comes under querulous scrutiny.

In conclusion, it should be noted that the major recommendations of the Office of Science and Technology were similar in several respects to a bill introduced by Senator Muskie on July 31, 1969. The bill was referred to a subcommittee of the Government Operations Committee, of which Senator Abraham A. Ribicoff of Connecticut is chairman. The subcommittee has held several hearings, including those in Baltimore and Milwaukee, but as yet has not reported the bill. In addition to this bill, the most advanced in the legislative process, at least six other proposals involving land-use controls over power plant siting are presently before the U. S.

disposing of waste heat, reducing and disposing of solid and gaseous wastes from fossil-fuel plants, improving methods of power generation and locating transmission lines underground.

Private industry should develop 'professional competence in regional planning, architecture, biology, ecology, and other environmental sciences,' and industrial expenditures on research and environment should be recoverable in rate-making.

Congress. These include bills introduced by Senators Cotton, Kennedy, Magnusson, and McGovern, as well as several similar pieces of legislation introduced in the House.

Land-Use Provisions

In addition to the numerous legislative proposals dealing with power plant siting, two more general land-use provisions have been incorporated by Congress into recent air pollution control legislation.¹ The land-use provisions can be summarized as follows:

1. That state implementation plans under the Clean Air Act as amended be required to consider the location of transportation and industry (among other things) as it relates to air pollution control; and
2. That the Federal Government, in setting emission standards for new industrial facilities, may also consider the location of those facilities as one of the factors to be weighed.²

Interpretation of these provisions is made difficult by the fact that the legislative language is extremely vague. However, if strictly interpreted, the first provision would appear to mean that, since the Federal Government could comment on and approve or disapprove land-use aspects of a state implementation plan, the state air pollution control agency would be obliged to prepare, in its pollution control efforts, a thorough land-use plan.

1. Clean Air Amendments of 1970, Secs. 110, 111. P.L. 91-604, 91st Cong.

2. The provision dealing with state implementation plans would be Sec. 111(a)(2)(d) of the Clean Air Act as amended. The provision dealing with certification of new facilities would be Sec. 113(e)(1). The appropriate Senate document is Report 91-1196.

The language of the second provision, which deals with new facilities, is discretionary in nature. The Federal Government may consider industrial location as one of the factors to be weighed. Certainly the language of the bill does not direct Federal authority to do this, and there would be obvious instances -- for example in remote rural areas -- where government officials doubtless would not wish to exercise detailed review over industrial location.

If government officials took advantage of this second land-use provision in administering the act, it would appear that the Federal Government could, in effect, veto most industrial development in areas already characterized by serious air pollution, although, again, it should be stressed that the language of the bill is vague. Presumably, the Federal Government would be allowed to review a new industrial facility at the planning stage. Although no formal authority is granted to the Federal Government, some sort of informal pre-certification seems implied at this stage. Should some form of veto be exercised, it would also appear that the Federal Government would have an obligation to indicate where the new facility should be located instead.

Increased Stack Heights

Another technique for improving the dispersion of pollutants from industrial sources is by increasing stack heights to vent emissions at a higher level in the atmosphere. Greater effective height may be achieved either by constructing taller stacks or by increasing the temperature and velocity of the exit gases.

An initial qualification about the use of increased stack heights is that stacks "high enough to be effective for pollution dispersion are practical only for power plants, and their value in urban areas is questionable [since] height may be limited by airway restrictions or by construction factors."¹ Until recently, however, the power plant industry apparently hoped to rely primarily upon tall stacks to disperse its gaseous wastes.²

An even more basic consideration is that increased stack heights -- whether in the form of taller stacks or higher temperatures and velocities at the stack exit -- are an effective solution to air pollution only if they provide "genuine vertical dispersion, carrying pollutants to higher levels of the atmosphere where they can be removed by natural processes."³

Buffer Zones

In some areas, notably New Jersey, regulations have been formulated for the purpose of creating "buffer zones". The rationale has been described recently by Anthony Low-Beer: "Assuming that the largest part of the pollutants will affect areas nearest the source

1. Office of Assistant Secretary for Planning and Evaluation, U. S. Department of Health, Education and Welfare, "An Economic Analysis of the Control of Sulphur Oxides Air Pollution," December, 1967, p. III-9.

2. U. S., Congress, Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Air Pollution (1967), 90th Cong., 1st sess., pp. 2043-2047, 2107-2118, 2278-2285, 2287-2316, 2550-2562, 2567-2589.

3. Charles L. Hosler, "Air Pollution and Plant Location," Appalachia, Vol. 3, No. 9 (1970), p. 3

itself, an increase in the surrounding territory will usually, other things being equal, increase the percentage of the damages suffered by the source operator himself and decrease the part suffered by persons other than the operator."¹ Clearly, in many areas it is impossible to establish buffer zones because the necessary acreage is not available. But where land can be purchased for the purpose, usually surrounding new industrial facilities, Federal assistance may be available. Two major sources of aid are the Open-Space Land Program of the Department of Housing and Urban Development and the Land and Conservation Fund program of the Department of the Interior.²

Summary and Conclusions

Despite the growing interest in land use controls involving planning and zoning, it is apparent that these techniques cannot provide a complete answer to the air pollution problem. Much research still needs to be done, particularly as regards the utilization of these techniques.³ As one authority has emphasized:

Research is necessary to determine what site will offer maximum dispersion and to determine the pollution

1. Anthony B. Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources" (unpublished Ph.D. dissertation, Columbia University, 1970). The author provides a technical analysis of the pertinent regulations and discusses in general terms the function of buffer zones.

2. For a further discussion of buffer zones, see Dorn C. McGrath, "Planning and Zoning--Can They Be Made to Work for Clean Air?" in Proceedings: The Third National Conference on Air Pollution (Washington, D. C.: 1966), p. 556.

3. For a discussion of this question, see J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970).

potential of various alternative sites and areas. To make these decisions, the behavior of the local atmosphere, particularly during periods with low wind speeds and stable air (inversion conditions) must be measured. Releasing and tracking zero lift balloons (balloons which displace a mass of air equal to their own weight) can determine the trajectory, or the path air follows, for varying conditions of wind and stability. In order to determine what typical patterns and concentrations would occur if a pollution source were present, tracers in the form of smokes, powders or gases can be released and their pattern of dispersal measured by air sampling. Soundings of the vertical temperature and the wind distribution in the first few thousand feet can be taken either by balloon, by light aircraft or sometimes by using towers to measure the lower levels. These soundings make it possible to compute the height to which smoke or vapor plumes will rise and to determine the rate at which pollutants will mix vertically in the atmosphere. Analysis of meteorological data from nearby weather-observing points will aid in calculating the average and maximum capabilities of the atmosphere to disperse and dilute pollution. Studies such as these sometimes will show that what might seem to be a minor change in plant location or design can lead to a major change in the dimensions of an air pollution problem.¹

As indicated above, similar empirical questions arise with regard to increased stack heights, which in some cases may furnish genuine vertical dispersion of pollutants and in other cases may simply transfer pollutants to the people who live downwind. Thus, according to the authority cited above, "There must be careful analysis of local meteorological data to determine whether tall stacks will be a genuine solution and how tall they must be to do the job."² It is understood that many of the answers to these

1. Charles L. Hosler, "Air Pollution and Plant Location," Appalachia, Vol. 3, No. 9 (1970), p. 3.

2. Ibid.

questions will be forthcoming by the Federally funded work now underway on design and construction techniques for tall stacks for very large power plants and by the programs now in progress on understanding the diffusion that results under varying meteorological conditions.

Assuming it can be demonstrated that some land use control techniques are of use for certain air pollution problems, a second set of questions concerns whether these techniques are administratively feasible. For example, what would be required in terms of manpower and money to carry out the land use provisions to the 1970 Clean Air Act? Or what kinds of information needs to be known in order to plan intelligently from an air pollution control point of view? What administrative capabilities are available at the state level to carry out these tasks?

A final consideration is that there are currently severe political limitations on the use of land use controls such as planning, zoning and increased stack heights. Given the political weakness of most local planning boards and the patchwork nature of local jurisdictions, a rational allocation of industrial locations in a metropolitan area or an equitable policy with respect to stack heights would be very difficult to realize. The struggle of many communities to obtain industries may also be a constraint. In short, the use of land is a singularly sensitive political issue. At the present time several state governments (notably Vermont and

Maine)¹ are trying to re-establish control over the use of their lands, but just how much state and local governments can realistically be expected to do about the use of land with respect to air pollution remains an unanswered question.

1. See "Land Use Regulation," CF Letter (Conservation Foundation), No. 11 (1970), pp. 2-4.

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CHAPTER 5

PRIVATE LEGAL ACTION¹

In certain circumstances, a private citizen may undertake legal action to force abatement of pollution or to prevent future pollution.² This section deals with various legal theories under which a party may claim a right to be free from air pollution and the remedies which are available to the aggrieved party. The various theories of liability require that the plaintiff show he has a right which the courts recognize and that the defendant violated that right. For example, to sue an automobile driver for striking a pedestrian crossing the street, one must show that the pedestrian has a right to cross the street unharmed and that the driver violated that right (i.e., he struck the pedestrian). Once this liability is established, one may seek a remedy to undo the wrong; in this case it would be money to compensate the pedestrian for the injury.

Following this basic distinction, the first part of this chapter deals with rights and the second part with remedies. The third part deals with procedural difficulties and the chapter concludes with a discussion of possible areas for legislative initiative

1. Perhaps the best overview of the private action in this area is Julian Juergensmeyer, "Control of Air Pollution Through the Assertion of Private Rights," 1967 Duke L. J. 1126.

2. Private legal action, as used here, refers primarily to private party suits against private sector polluters. Thus, the present chapter does not discuss legal action brought by governmental agencies in enforcing air pollution control programs; and the possibility of private suits against public officials is dwelled upon only briefly.

to expand and facilitate private legal action on matters of environmental quality and particularly air pollution.

Rights

In the following section, four rights are discussed with specific reference to air pollution:

- 1 - The right to use and enjoyment of property (nuisance);
- 2 - The right to exclusive possession of property (trespass);
- 3 - The right to have a public official do his legally required duty (mandamus); and
- 4 - Constitutional rights.

Nuisance: Use and Enjoyment of Property

As early as 1610, a party seeking abatement of an air pollutant used the common law action of nuisance.¹ Succinctly, a nuisance is a substantial and unreasonable interference with the use and enjoyment of one's property.² Under this theory, one has a right to use and enjoy his property substantially free from interference of other parties. In practice, what constitutes a "substantial and unreasonable interference" becomes a factual ques-

1. William Aldred's Case, 9 Co. 57b, 77 Eng. Rep. 816 (K.B.1610).

2. Some authorities question the inclusion of "unreasonable," but a reading of the cases indicates it is always a consideration--if only implicitly.

tion which varies from case to case.¹ "It suffices to say as to this that the conditions constituting a nuisance at a given time and place may not be a nuisance at another time and place."²

With regard to air pollution, the nuisance action is used when one is constantly, or even for a short period, irritated by smoke, smells, or some other form of pollution which is being generated from a particular source. Certain characteristics of the nuisance action that differentiate it from other actions, or make it suited to particular situations, are discussed below.

Prescriptive Right. When someone openly uses property for an extended period of time (usually about 15-20 years), his use may have become protected as a "prescriptive right"³, i.e., as a form of

1. Contrast this to statutes (legislation) where the standard is well-defined (e.g., no. 2 on the Ringelmann Chart). Where the standard is well-defined, the potential polluter knows what standard he will be held to and the potentially injured party obtains a better idea of the merits of his case. However, a well-defined standard may be used as a defense by the polluter who is within the standard but nevertheless is a nuisance. Ill-defined standards such as those used in nuisance actions, lead to considerable uncertainty, but they have the advantage of being flexible enough to meet varied situations.

2. Board of Health v. New York Central R.R., 4 N.J. 293, 72 A.2d 511, 514 (1950).

3. Briefly, the legal requirements are for open, continuous and exclusive ownership under a claim of right for a statutory period. A comprehensive discussion of prescription and the law of nuisances is contained in H. G. Wood, The Law of Nuisances (San Francisco: Bancroft-Whitney Company, 1883), pp. 763-793.

property. Perhaps the best known example of this concept is squatter's rights. In the environmental field, prescriptive rights apply where pollution has been allowed to continue unabated for a long period of time without anyone attempting to bring a private action to stop it. In such cases, the polluter may have acquired a right to pollute notwithstanding the nuisance. This doctrine is not uniformly applied from jurisdiction to jurisdiction¹ and appears to be losing importance, particularly since the courts are making it increasingly difficult for the offender to prove his long standing pollution.² To the extent that a prescriptive right can be established, it may condemn the community to endure existing pollution.³

Coming to the Nuisance. If one freely chooses to dwell in an area already polluted by a particular source, some courts hold that the individual has "come to the nuisance" and is thereby pre-

1. For example, "It is clear. . .that one may not obtain by prescription. . .a right to cast sewerage upon the lands of another without his consent." Aubele v. A. B. Galetovich, Inc., 83 Ohio L. Abs. 200, 165 N.E.2d 683 (1960).

2. Prescriptive rights may be granted only for the minimum level of pollution which has been constantly emitted over the period of time in question. This requirement applies to both the degree and kind of the pollutants discharged. Thus, for example, no prescriptive rights would be granted if there were a complete stoppage of emissions at any time over the prescriptive period. Inasmuch as the prescriptive period is generally 15-20 years, this requirement makes acquisition of a prescriptive right very difficult. See Curry v. Farmers Livestock Market, 343 S.W.2d 134 (Ky. 1961) at 137.

3. H. G. Wood, in The Law of Nuisances (San Francisco: Bancroft-Whitney Company, 1883) noted that, with very few exceptions, a prescriptive right cannot be lost once acquired (p. 793). However, the community could use its powers of eminent domain to condemn property (the prescriptive right), but this could be quite expensive.

cluded from complaining. While most courts do not favor use of this doctrine,¹ it is at times used in determining the nature of the remedy once liability is shown,² particularly in reducing the amount of damages awarded.

Anticipatory Nuisance. In the absence of central treatment facilities for air, it is frequently more effective for pollution control purposes to prevent construction of a source of potential pollution than to bring a legal action after the source has been built and operating. In this connection, however, it is extremely difficult to prosecute successfully an "anticipatory nuisance," a potential source of pollution which has not actually caused any damage. The courts have held consistently that they will not halt construction when the evidence fails to show convincingly, beyond "the mere possibility or even probability of harm," that the plaintiff will suffer.³ Since most firms can get expert testimony showing there will be no harm, this type of action rarely succeeds.

1. See William Prosser, The Law of Torts, 2d ed., (St. Paul: West Publishing Company, 1955), p. 425. Basil Jones, in The Law of Real Property, 3d. ed., (Chicago: Callaghan and Company, 1939), indicates that use of this doctrine is now rare (p. 112).

2. See the discussion of "Injunctions," below.

3. Commerce Oil Refining Co. v. Miner, 281 F.2d 465 474 (1st Cir. 1960). This case presents an interesting discussion of anticipatory nuisance as it relates to SO₂ emissions.

Inverse Condemnation.¹ Inverse condemnation is the popular description of a suit brought against the government "to recover the value of property which has been taken in fact by the governmental defendant, even though no formal exercise of the power of eminent domain has been attempted by the taking agency."² This concept has been applied almost exclusively to situations where aircraft habitually flew so low over property as to constitute an interference with use and enjoyment of the land. Thus, there would be a "taking" of property without compensation in violation of the Fifth Amendment.³

Two recent California cases⁴ have extended this concept to include decreases in property value due to excessive noise, smoke, vibrations, and fumes caused by jet aircraft operating from government owned airports. From these cases, it is clear that inverse condemnation may become available for those persons living near

1. Although strictly speaking, an inverse condemnation is a form of action in itself, it is discussed here because it involves impairment of the right to use and enjoyment of property and also because it has had rather limited application.

2. Thornburg v. Port of Portland, 233 Ore. 178, 376, P.2d 100, 101 (1962).

3. The Fifth Amendment states that ". . . nor shall private property be taken for public use, without compensation."

4. Aaron v. City of Los Angeles, (Super. Ct., Calif. No. 837799), 1970, and Greater Westchester Homeowners' Association v. City of Los Angeles, (Super. Ct., Calif. No. 931979), 1970. In the former case, a judgment of over \$750,000 was awarded.

airports who now are condemned to breathe the noxious fumes. An extension of the reasoning of the California cases would apply inverse condemnation to other forms of damage caused by governmental polluters, such as decrease in property value from odors, impairment of view, or the health of plants or animals. However, it is important to emphasize that inverse condemnation can be used only against governmental polluters and not against all polluters and as a result, the scope of its application is limited.

Causation. Perhaps the most difficult problem in showing the liability of a polluter is proving that the damage to the plaintiff is a direct result of the emissions of the polluter. To take an obvious example, only where the source is immediately adjacent to the plaintiff or where the pollution occurs in a sparsely settled area does the plaintiff stand a reasonable chance of showing causation.¹ The causation requirement is particularly onerous in urban areas where pollution is often the worst, because it is practically impossible for legal purposes to isolate one or two sources of

1. Distance alone is not the determining factor, however. In United Verde Extension Mining Co. v. Ralston, 37 Ariz. 554, 296 P. 262 (1931), a nuisance was found even though the parties were sixteen miles apart.

pollution and prove they caused the nuisance.¹ Many courts will not allow a number of polluters to be joined as defendants unless the injured party is prepared to show the specific contribution of each polluter to his harm.² Moreover, the problem is aggravated when pollutants interact synergistically in the air and the resulting chemical is the irritant. In that situation, the polluter is not held liable because the damage is not considered to be directly caused by his pollution. As a practical matter, therefore, most urban dwellers cannot rely upon this. Nuisance is ineffective in handling pollution in areas where there is more than one source of pollution; at best, only one or two of the many sources of air pollution would be eliminated.

Establishing "Unreasonableness". A plaintiff in a nuisance action must not only prove that he was damaged, but also that the defendant's actions are unreasonable. Stated otherwise, establishing "unreasonableness" entails a determination of what is "reasonable"

1. However, there is one discordant view among the commentators on this problem. Paul Rheingold, in "Civil Cause of Action for Lung Damage Due to Pollution of Urban Atmosphere" (33 Brooklyn L.R. 17 (1966) at 28), suggests that it would take no more than three defendants joined together for a plaintiff to have the major urban polluters in one suit. However, he offers no authority and it is unclear how he arrived at the conclusion. Further, even this approach leaves unresolved the problem of distributing liability for damages. Lawrence Pollack, "Legal Boundaries of Air Pollution Control--State and Local Legislative Purposes and Techniques" (33 Law and Contemporary Problems, 331 (1968) at 334) notes that "no single identifiable source may be large enough or visible enough to be held responsible for specific damage."

2. See Richard Aborn and Carl Axelrod, "Air Pollution Legislation", 9 B. C. Comm. & Ind. L.R. 712 (1968) at 717.

under a particular factual situation.¹ Thus, the plaintiff (and for that matter the defendant) is left in a state of uncertainty, for even if liability and substantial interference are shown, the courts may rule that the offender's actions are reasonable and therefore allowable.² These problems - of showing liability and of obtaining injunctive relief - are discussed further below under "Injunctions."

Public Nuisance.³ While most nuisances are private nuisances, if pollution from a particular source is widespread and injurious to a large number of property owners, some courts will label this a "public nuisance." Public nuisance differs from private nuisance basically in the number of people affected. Courts hold generally that only a public official can bring an action to remove

1. At least implicitly, it appears that "reasonableness" also enters into consideration of the care taken by the offending source. Thus, we are concerned here both with reasonableness of the type of activity of the offender and reasonableness of his efforts in minimizing the offending pollutants.

2. In Waschak v. Moffat, 379 Pa. 441 109 A.2d 310 (1954), the court held that hydrogen sulfide given off by mounds of waste products from coal purification process was not unreasonable even though it discolored the paint of the plaintiff's house. Certainly one is hardpressed to see how this is reasonable. See "Air Pollution As A Private Nuisance," 24 Wash. & Lee L.Rev. 314 (1967).

3. See generally William Prosser, "Private Action for a Public Nuisance," 52 Va. L.Rev. 997 (1966). Also Richard Aborn and Carl Axelrod, "Air Pollution Legislation," 9 B.C. Comm. & Ind. L.Rev. 712 (1968) at 720.

a public nuisance.¹ The theory is that the public in general is aggrieved and therefore a representative of the public should sue to redress the wrong.²

A nuisance may be both a public nuisance and a private nuisance.³ A person who is damaged may sue for his personal damages, but he cannot sue for the damage of others. This can only be done by a public official suing for a public nuisance.⁴

While this may appear logical superficially, there are many reasons why this is a much less effective remedy for the person who is privately damaged. The principal reasons are the time and costs involved in a court suit and the remedy which the court will give. The time to achieve a court decision is much longer for private actions because injunctions are rarely permitted as a remedy, while an injunction is the usual remedy for public nuisance. This is important because courts give injunction requests immediate

1. A public nuisance is considered a common law crime and a criminal penalty may be sought, although an injunction is the usual form of relief.

2. It should be noted that a public nuisance can never acquire a prescriptive right. H. G. Wood, The Law of Nuisances (San Francisco: Bancroft-Whitney Company, 1883), p. 790.

3. William L. Prosser, "Private Action for Public Nuisance," 52 Va. L.Rev. 997 (1966) at 999.

4. Often a plaintiff is also required to show that the harm he suffered was different from that suffered by the general public. Legal Control of Water Pollution, 1 U.C.D. L. Rev. 126 (1969). When this requirement is enforced, it makes recovery for private nuisance nearly impossible since it would be rare for an individual to suffer an injury from air pollution unlike that suffered by others.

priority, while other claims must be placed at the end of long civil court calendars. As a result, public nuisance actions are resolved much more quickly than private nuisance actions.

Even more significant than the time problems are the cost problems. The costs of litigating a court case are so high that a private nuisance claim of less than \$1,000 is not worth pursuing, particularly in light of the amount of effort required to prove causation.¹ Government not only has more resources available for proving public nuisance, but it can also spread the costs of suing because it is only slightly more expensive to sue in public nuisance than for a single private nuisance action.²

Finally, the kind of remedy available for public nuisance is a more satisfactory remedy for someone who is damaged. In a public nuisance action, the remedy is to stop the pollution through an injunction. However, an injured party suing for private nuisance can rarely have the polluting conduct stopped, and instead would receive damages.³ Damages usually do not include payment for health

1. Proving pollution is complicated and requires extensive preparation and use of expert witnesses, both of which are very expensive. See Legal Control of Water Pollution, 1 U.C.D. L. Rev. 126 (1969); and "Statutory Treatment of Industrial Stream Pollution," 24 Geo. Wash. L. Rev. 302 (1956), at 310.

2. However, government involvement is not always advantageous. Enforcement may be impaired by inadequate funding and incompetent or disinterested personnel, particularly at the state and local level. Orlando E. Delogue, "Legal Aspects of Air Pollution Control," 1969 Wis. L.Rev. 884 at 887.

3. Richard Aborn and Carl Axelrod, "Air Pollution Legislation," 9 B.C. Comm. & Ind. L. Rev. 712 (1968) at 720.

or aesthetic injury, and the costs of the suit, including attorney fees, must be paid. In addition, there is no relief available for the person who does not sue because the cost of suing is too high. Such a person would continue to bear losses from the pollution since an injunction would not be available to prevent it.¹ However, an injunction resulting from a public nuisance action would prevent future damage, although it could not provide any assistance to those who had been damaged in the past.

The problems of time, costs, and remedies available are discussed in more depth in the sections of Procedural Problems and Remedies.

Despite its advantages over private nuisance, public nuisance has severe limitations upon its ability to control pollution. While it cures some problems from which private nuisance suffers, it is still subject to the difficulties in proving that the specific polluting conduct caused the specific injury. This causation problem, discussed earlier, limits public nuisance's usefulness in controlling air pollution.²

Independent from State and Local Legislation. An advantage of the nuisance action is that it does not depend upon state or local legislation, and, in fact, the nuisance action cannot be denied by

1. "Water Quality Standards in Private Nuisance Actions," 79 Yale L. J. 102 (1969) at 109.

2. An illustrative example of the problems with a public nuisance is the Hopfenmaier Rendering Plant in Georgetown. See "City Fails to Find Odors Noxious," in Washington Post, Oct. 2, 1970, p. B1.

by statute. Consequently, the nuisance action gives the individual the opportunity to act where pollution control legislation does not exist, or where enforcement is lax, ineffective, or nonexistent.¹ In many states, a nuisance action is the only weapon available if a plaintiff chooses to act individually. In these cases, and particularly where local governments are desperately in need of revenue and listen strongly to local economic interests to the detriment of the homeowner or urban dweller, the importance of private action varies inversely with the amount of government action. In fact, so important is the nuisance doctrine that the courts often hold that the offended party cannot be deprived of his right of action merely because the polluter has obtained sanction for his activities through compliance with zoning regulations.²

Nuisance Summary. A nuisance action is practically the only legal means in individual--as an individual--has to assert his right to clean air. Historically, however, the nuisance action in

1. "Equity and the Eco- System: Can Injunctions Clear the Air?" 68 Mich. L.Rev. 1254 (1970), note 32 at 1259. The importance of private action which can be taken independently of government support can be seen in the recent discussion of consumer legislation in the U. S. Congress. One approach would allow the consumer to act independently of the government while another would require the consumer to wait until the government has acted.

2. See, for example, "Real Property--The Effect of Zoning Ordinances on the Law of Nuisances," 54 Mich. L.Rev. 266 (1965). Moreover, it has been held that a private nuisance action is available even where a local board of health has set pollution standards. The standards do not preempt the right of private action. Board of Health v. New York Central R.R. 10 N.J. 294, 90 A.2d 729 (1952) at 735.

in air pollution cases has not been a notable success.¹ As noted above, it is extremely inefficient in terms of time and cost to the individual and, therefore, remains beyond the reach of most citizens.² However, it may be that the tremendous increase in public concern for air pollution abatement, a growing body of knowledge of the health and other effects of pollution, and the increase in litigation will bode well for a more effective use of nuisance action. But a more likely result is that the problems, especially causation, will persist, and that private nuisance will continue to be an effective pollution control tool only in rare cases.

Trespass: Exclusive Possession of Property

An alternative theory for a private action is to assert that emissions from the defendant's source of pollution injured the plaintiff's property and hence constituted a trespass. Legally, a trespass is "an invasion of the plaintiff's interest in the ex-

1. It has been suggested by Leonard Miller and Doyle Borchers that "In this sense (of developing issues), a tort action is not a part of the control scheme, but a method for highlighting the need for a solution." The Role of the Private Lawsuit in Air Pollution Control: Speculations on Court Usage of Government Materials, presented at the Annual Meeting of the Air Pollution Control Association, New York, N. Y., June 22-26, 1969, p. 1. To the extent that this comment is true, it reflects poorly on the efficacy of the nuisance action, but well on nuisance action as a means of influencing public policy.

2. Commenting on a court decision which favored the individual over the economic interest, Orland DeLogu notes that "Though the California court's reasoning in many respects commends itself to us, the hard economic facts of life have relegated this approach to a minority position." Orlando DeLogu, "Legal Aspects of Air Pollution Control and Proposed State Legislation for Such Control," 1969 Wisc. L.Rev. 884, at 889.

clusive possession of his land."¹ Thus, trespass involves a physical interference with the use of property, while nuisance is non-physical interference which annoys or disturbs the use of property. Procedurally, there are major differences between trespass and nuisance: first, the statute of limitations runs longer for a trespass;² second, the trespass action arises as soon as there is an act of trespass, while the nuisance action does not arise until there is a substantial interference with plaintiff's use of his land; third, a trespass suit can be initiated without regard for the reasonableness of the defendant's actions; and fourth, an intentional trespass requires no proof of damages to be actionable, but an intentional nuisance does.

Trespass Applied to Air Pollution. Usually, there is no trespass unless the pollutant is tangible,³ but three cases involving the Reynolds Metals plant in Troutdale, Oregon, indicate that this

1. William Prosser, The Law of Torts, 2d ed. (St. Paul: West Publishing Company, 1955), p. 409.

2. This has two effects. First, an action for trespass can be brought a longer time after the trespass than an action for nuisance can be brought after the nuisance. Second, damages under trespass will be accumulated over a longer period of time than under nuisance. For example, assume both a continuing trespass and a nuisance from 1950-56 and the action is brought in 1956. If the Statute of Limitations is two years for nuisance and six years for trespass, the plaintiff would recover under trespass for damages during 1950-56 but under nuisance he would recover only for the period 1954-56. The major advantage in this is that the plaintiff may sue every six years, rather than having to sue every two years. The statute of limitations is discussed in depth later.

3. See generally the annotation at 54 A.L.R. 2d 778. Also Richard Aborn and Carl Axelrod, "Air Pollution Legislation," 9 B.C. Comm. & Ind. L. Rev. 712 (1968) at 719.

rule may be broadened.¹ In the most important case,² the plaintiff owned a cattle farm and brought an action for trespass asserting that fluoride emissions from the plant's smokestacks were being deposited on the farm and causing damage. The court upheld the plaintiff's contention by declaring that the present state of scientific knowledge has advanced to the point where trespass actions should be allowed notwithstanding an inability to see the particles. A quick perusal of the cases, however, indicates that this theory is adhered to by only small minority of the jurisdictions.

The courts have usually viewed this use of trespass with little favor because it does not fit traditional trespass theory, which requires a direct and substantial physical entry by a person or object.³ Unfortunately, airborne objects or gases are rarely viewed as substantial. Instead, courts have usually preferred to view trespass suits as attempts to circumvent the more rigorous nuisance requirements, and for this reason, trespass suits are rarely accepted or used to control pollution. However, more widespread acceptance of the theory approved by the Oregon Court,

1. Anderson v. Reynolds Metals Company, 125 F. Supp. 481 (W.D. Wash. 1954), aff'd, 236 F.2d 224 (9th Cir. 1956), cert. denied, 352 U.S. 968 (1957); Fairview Farms, Inc. v. Reynolds Metals Company, 176 F. Supp. 178 (D. Ore. 1959); Martin v. Reynolds Metals Company, 221 Ore. 86, 342 P.2d 790 (1959), cert. denied, 362 U.S. 918 (1960); also, Martin v. Reynolds Metals Company, 337 F.2d 780 (9th Cir. 1964).

2. Martin v. Reynolds Metals Company, 221 Ore. 86, 342 P.2d 790 (1959).

3. Richard Aborn and Carl Axelrod, "Air Pollution Legislation," 9 B.C. Comm. & Ind. L. Rev. 712 (1968) at 719.

mentioned above, may be of considerable significance.¹ If this were done, suits for trespass would offer the advantages of being more concerned with protecting the interests of the aggrieved landowner than nuisance action and there would be less reliance on the "reasonableness" criterion.²

Constitutional Rights³

In recent years, a body of thought has begun to develop which asserts that there is a constitutional right to a clean environment, and there have also been many attempts to explicate that right in state constitutions. In Griswold v. Connecticut,⁴ the Supreme Court held that the Ninth Amendment⁵ guaranteed to the people certain fundamental rights beyond those enumerated in the first eight amendments of the Bill of Rights. Based on this theory, attempts are being made to show that the environment is

1. The Martin case is discussed in "Air Pollution Legislation," 9 B.C. Ind. & Comm. L. Rev. 711 (1968) at 719-720. The authors assert, and probably are correct, that the court in Martin recognized that this use of the trespass action would be too burdensome to industry and hence a "balancing of equities" would be required as is the case in a nuisance action. In this connection, see the discussion of "Injunctions" below in this chapter.

2. Julian Juergensmeyer, "Control of Air Pollution Through the Assertion of Private Rights," 1967 Duke L. J. 1126 (1967) at 1138-1142, appears to take the view that this form of action (trespass) is a viable alternative to the nuisance but support for this contention is hard to find.

3. The leading article on this subject is "Toward a Constitutionally Protective Environment," 56 Va. L. Rev. 458 (1970).

4. 381 U.S. 479 (1965).

5. "The enumeration in the Constitution, of certain rights, shall not be construed to deny or disparage others retained by the people."

constitutionally protected.¹ Basically, the right would protect against "unreasonable environmental degradation."² However, from the point of view of current litigation, the constitutional argument will be of little use because it will be a long time before it comes to fruition.

The National Environmental Policy Act of 1969³ contains language which may be construed as a Congressional recognition of this right. Specifically, Section 101(c) states, "The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enrichment of the environment."⁴ Thus, there is an ever increasing recognition of a constitutional right to a clean

1. At present, a number of other obstacles (such as standing to sue) must be overcome to get to the argument on the merits. One way in which some plaintiffs are getting into court on this argument is to assert that his Constitutionally protected rights are being deprived and hence he has a civil action under 42 U.S.C., Section 1983 (Civil Action for Deprivation of Rights).

2. "Toward a Constitutionally Protected Environment," 56 Va. L. Rev. 458 (1970) at 473.

3. National Environmental Policy Act of 1969, P.L. 91-190, 83 Stat. 852-853.

4. Ibid.

environment and unquestionably there will be litigation to develop and define that right.¹

Mandamus²

If a public agency or official is lagging in pollution abatement by failing to do something that is requested by law, a citizen may bring a court suit in mandamus to compel the required action. A writ of mandamus is simply an order by a court requiring that a specified thing be done and is available only against a public agency or official. For example, if a public hearing is required before a governmental agency makes a particular decision, a suit in mandamus would compel the agency to hold the hearing. The party bringing the action must show it has an interest in the

1. For an example of an action already filed which is based on the constitutional argument, see Environmental Defense Fund, Inc. v. Hoerner Waldorf Corp., Civil No. 1694 (D. Mont., 1970). Decided on August 27, 1970, the court rejected EDF's request for an injunction without getting to the constitutional argument, although the court indicated that the constitutional argument would not stand in this case because the citizen is constitutionally protected only against pollution caused by a governmental action and there was no evidence here that a governmental body acted to pollute. The court suggested that the citizens living near the offending plant bring a nuisance action to stop the pollution.

2. Mandamus would properly be included as either a right or a remedy, since it is actually both. It is a remedy to enforce the right of private citizens to require public officials to perform their statutory duties. Mandamus is the right to have a public official act properly, and violation of the right is remedied by having the official act properly. It is important to note that this remedy is available for mandamus only, while all other rights may be remedied by damages or an injunction.

sought-for activity or will be affected by it;¹ and he must also demonstrate that the activity is ministerial in nature and not discretionary.²

With regard to air pollution, the use of this action will probably be most effective in compelling public hearings where the relevant statutes require them. In a recent Minnesota decision,³ the court granted a writ of mandamus in an action brought by a conservation group to compel the Minnesota Pollution Control Agency to hold hearings on a permit revocation based on a firm's excessive discharge of pollutants into Lake Superior. The court held that, inasmuch as the statute created the necessity for a hearing, the public had a right to enforce holding that hearing. Cases within the past few years indicate a greater willingness on the part of the courts to allow the public to play a role in the decision-making process, at least to the extent of having its views heard. Mandamus can play an important role in ensuring that these views are heard.

1. This is the "standing to sue" question. The issue is whether the party bringing the action has enough interest in the action or its outcome to be allowed to be a party to the action. Thus, person A cannot sue person B who ran over person C, unless A has enough interest in the action or its outcome (for example, by being married to C). For further discussion, see the discussion of "Standing" later in this chapter.

2. If the statute allows the official any choice in not performing the activity, or leaves open the time for performance, the court will not issue a writ of mandamus. Moreover, the court cannot influence any decision by a public official or body; it can only compel that the decision be made.

3. Sierra Club v. Minn. Pollution Control Agency, No. 662,008 (Cir. Ct. Minn. Oct. 3, 1969).

Under Federal law, until 1962, anyone wishing to seek a writ of mandamus against the Federal government had to bring the action in the U. S. District Court in Washington, D. C. For anyone not living near Washington, D. C., this burden was usually overwhelming. In 1962, the Mandamus and Venue Act¹ was enacted and this allowed an action for mandamus to be initiated in any U. S. District Court. In addition, the Clean Air Amendments of 1970 provide that the Administrator of the Environmental Protection Agency may be sued "where there is alleged a failure of the Administrator to perform any act or duty under (the Clean Air) Act which is not discretionary with the Administrator."² This is in effect a broad grant to private parties of the power to use mandamus against the Administrator. Thus, the remedy of mandamus is now generally available to provide relief in those situations where a public official has failed to do a ministerial duty.

Remedies

In the following section, two basic remedies are discussed with specific reference to air pollution: the first is monetary damages (the most common form of remedy); the second, injunctions (whereby pollution can be stopped completely or the installation of control devices may be required).

1. 28 U.S.C. 1961.

2. Sec. 304(a)(2), Clean Air Amendments of 1970, P.L. 91-604, December 31, 1970.

Damages

A court award of monetary damages is the most common form of remedy. In a nuisance action, when some form of actual damage is shown ("substantial damage"), the aggrieved party will be awarded monetary damages,¹ even when his actual damage is nonmonetary.² In a trespass action, money damages can be awarded even where there is no showing that any actual damage has been sustained. Although there are certain legal questions involved in determining liability, questions which undoubtedly color the disposition of the court to grant monetary damages, in many air pollution cases the polluter has intentionally created the condition of which the plaintiff is complaining and the plaintiff would be awarded compensation for the damage that can be shown.³

Monetary damages can be used for more than compensation for past injuries. For example, if the offender is particularly flagrant in his disregard for the rights of others, punitive damages

1. For an excellent judicial discussion of damages in a nuisance action, see Spaulding v. Cameron, 38 C. 2d 265, 239 P.2d 625 (1952).

2. See William Prosser, Law of Torts, 2d ed. (St. Paul: West Publishing Company, 1955), pp. 416-417.

3. In "Air Pollution As A Private Nuisance," 24 Wash. and Lee L. Rev. 314 (1967), the author discusses the Restatement of Torts rule for creating nuisance liability and indicates (correctly) that there is no liability unless the offender was, inter alia, "substantially certain that the invasion will result from his actions" (at 318, quoted from Restatement of Torts, p. 238). The position taken in this section is that most air pollution cases can maintain this showing and thus there is no problem.

may be allowed.¹ Further, where the pollutant is in effect a "permanent nuisance" in the sense that it will continue in the future to be a nuisance or a trespass, it may be labelled a permanent nuisance and the offended party can in some jurisdictions be granted a judgment for diminution in the value of his property.² An inverse condemnation is, in effect, this same mechanism, but can be used only where the defendant is a government agency.

As a practical matter, the amount of damages a polluter is required to pay is often miniscule in comparison to the value to the polluter of continuing to pollute.³ Therefore, while the damages may adequately compensate the offended party, they are not likely to reduce the pollution.

Injunctions

When the offended party can not be adequately indemnified by money damages, an injunction can be sought to stop the pollution completely or to require the polluter to install abatement devices.⁴

1. See, for example, McElwain v. Georgia-Pacific Corporation 245 Ore. 247, 421 P.2d 957 (1966).

2. On this point, see Charles McCormick, Law of Damages (St. Paul: West Publishing Company, 1935), pp. 500-515. However, in effect, this may be a license to pollute since the plaintiff cannot sue again for damages caused by the particular polluting conduct involved.

3. In Martin v. Reynolds Metals Company, 337 F.2d 780 (9th Cir. 1964), a representative of the firm admitted that it was cheaper for them to continue paying damages than to alter their production method. Martin would periodically bring an action to recover his losses of the previous few years.

4. Injunctions are not usually combined with a request for damages, although they are occasionally. "Equity and the Eco-System: Can Injunctions Clear the Air?" 68 Mich. L. Rev. 1254 (1970) at 1262.

Although the courts are reluctant to issue an injunction,¹ some large operations have been shut down by one irate and determined homeowner.²

Balancing the Equities.³ In most situations, when a court is asked to grant an injunction, it may adopt one of two approaches. It can assert that the right to be free of the pollutant (regardless of the theory--nuisance, trespass, or constitutional) is an important right which should not be denied merely because large economic interests are involved. Alternatively, the court can weigh the cost of closing the source against the benefits to the aggrieved party. It is this latter approach, "balancing the equities," which is most often used.

It is readily apparent that more often than not, the scales will tend to tip in favor of the polluter, at least in part because while many people are irritated by the pollutant, it is only the one party bringing the action whose interests are weighed in favor

1. To grant an injunction, the courts always require that the plaintiff show that he would be irreparably damaged and that he would have no adequate remedy if the pollution were allowed to continue. Thus an injunction is used generally to prevent future injury, although proof of potentially irreparable damage is largely based upon polluting conduct of the past.

2. See, for example, Hulbert v. California Portland Cement Company, 161 Cal. 239, 118 P. 928 (1911).

3. An excellent review of the use of injunctions in air pollution cases is "Equity and the Eco-System: Can Injunctions Clear the Air?" 68 Mich L. Rev. (1970).

of the injunction.¹ A classic example of this weighing is Monroe Carp Pond v. River Raisin Paper Company² where the plaintiff, who was put out of business, was denied an injunction because the plaintiff's business employed five people and was worth about \$10,000, while the defendant firm supplied employment for about 3,000 people and was worth \$15 million.³

One difficulty with balancing the equities arises from the inability to predict outcomes due to the absence of clear standards for weighing the interests. Certain factors are usually considered, such as, "location, nature of the use, character of the neighborhood, extent and frequency of the injury, and the effect on the enjoyment of life, health and property,"⁴ as well as zoning ordinances.⁵ Nevertheless, often the aggrieved party can be expected to enter the courtroom with little idea of his potential for success.

1. Julian Juergensmeyer, "Control of Air Pollution Through the Assertion of Private Rights," 1967 Duke L. J. 1126 (1967), examines this point and concludes that the use of the balancing test would be much more effective if the benefit to all of the offended parties were considered even though only one of them brought the action. The balancing would then be more socially realistic. P. 1134.

2. 240 Mich. 279, 215 N.W. 325 (1927).

3. A more up-to-date example of the problems involved in weighing interests is Boomer v. Atlantic Cement Co., Inc. No. 242, March 4, 1970 (N.Y. Ct. App.).

4. 66 Corpus Juris Secundum, Nuisance, Section 23, p. 777.

5. See Martin v. Reynolds Metals Co., 337 F.2d 780 (9th Cir. 1964). In balancing the equities, the courts will naturally look to the interests and wishes of the community. Zoning ordinances are perhaps the most explicit manifestation of those wishes. Nevertheless, it bears repeating that conformance with zoning requirements in and of itself does not relieve the polluter of liability.

Looking to the future, it would appear that current interest in air pollution abatement and the spate of recently enacted statutes in this area will indicate to the courts that public sentiment is swinging away from absolute protection of local economic interests and is moving toward protection of the right of the individual to environmental quality. Moreover, the availability of abatement technologies of differing types and degrees of effectiveness gives the courts leeway in shaping solutions which can be beneficial to both parties, rather than damaging one to benefit the other.

In the past, the difficulties inherent in obtaining an injunction have made it rarely successful as a pollution control technique. Because an action for damages is usually clearly inadequate, equitable relief (injunctions) should be generally available in air pollution cases. In practice, however, the extreme nature of the burden that has been placed upon the plaintiffs in most cases of this type has prevented success in suits against all but the most blatantly culpable polluters.¹ While there is some hope for the future,² injunctions are likely to continue to be used rarely.

1. "Equity and the Eco-System: Can Injunctions Clear the Air," 70 Mich. L. Rev. 1254 (1970) at 1263.

2. See "Equity and the Eco-System: Can Injunctions Clear the Air," 70 Mich. L. Rev. 1254 (1970).

Procedural Problems

Even when a plaintiff is able to show that his rights have been violated and could obtain an appropriate remedy, he may find his way blocked by procedural problems that limit or preclude relief. The procedural problems discussed here are: standing, time and cost limitations, the statute of limitations, problems with proving damages to health or aesthetics, and sovereign immunity.

Standing

To be able to bring a suit in a court, a party must have standing, which means enough personal interest in the case to have a substantial stake in the outcome. For this reason, a person can assert the violation of a right only if he is substantially affected by the infringement or potential infringement of that right.

The level of interest that a plaintiff is required to have presents a difficulty.

The individual plaintiff who is able to show that pollution will cause actual or threatened economic loss to him or damage to his health, will not face difficulty in establishing that he has standing. But in cases instituted by plaintiffs such as conservation groups, who must rely on amorphous injuries to intangible interests, the standing issue poses a real obstacle to successful litigation.¹

Standing problems usually arise in cases where government action could impair the environment. There are two major tests for standing that a plaintiff must pass in such cases: first,

1. "Equity and the Eco-System: Can Injunctions Clear the Air?" 70 Mich. L. Rev. 1254 (1970) at 1275.

whether a private legal interest has been affected by the government; and second, whether the harm suffered by the plaintiff is a compensable harm. In the past, compensable harm has meant strictly economic damages, but recent court decisions have broadened compensable harm to include damages to aesthetics or historical areas.¹ The Supreme Court has agreed to hear a very significant standing case, Sierra Club v. Hickel, which will determine how the standing concept is applied over at least the next decade.²

Cost and Time

Other considerations with regard to nuisance actions are cost and time. For most private citizens, the cost of a nuisance action could be prohibitive--particularly if there is an appeal. These costs, of course, may be less burdensome if the plaintiff is supported by legal action groups or conservation groups.³ For this reason, class actions, as discussed below, may have considerable appeal.

An additional problem concerns the lapse of time before final judgment. Many cases have taken five or more years to reach final judgment from the time when court consideration of the nuisance

1. Frederick S. Richards, "Walton v. St. Clair: The Standing Question," 4 Natural Resources Lawyer 47 (1971).

2. Washington Post, February 23, 1971, A-2.

3. The problem some public interest law firms are currently having with their tax-exempt status under Section 501(c)(3) of the Internal Revenue Code of 1964 indicates how tenuous their position may be. See "Regulating the Political Activities of Foundations," 83 Harv. L. Rev. 1843 (1970).

was initiated. The prospect of drawn-out legal processes, therefore, is hardly an enticing one to parties who are irritated now.¹

Statute of Limitations²

The statute of limitations is often quite short for nuisance actions, usually about two years. Thus, if a particular pollution source has been polluting for say, ten years, in an action for nuisance the polluter could be held liable only for the last two years because the statute of limitations has run with respect to the first eight years.

Aesthetics and Health

Historically, the courts have recognized a cause of action primarily for what might be called "aesthetic considerations;" for example, where one's enjoyment of his property is disturbed by dust,³ obnoxious odors,⁴ smoke,⁵ fumes,⁶ and many other types of pollutants. Until recently, however, the courts have not fully

1. These difficulties are noted in Richard Aborn and Carl Axelrod, "Air Pollution Legislation," 9 B.C. Comm. & Ind. L. Rev. 712 (1968) at 718.

2. The statute of limitations is that period of time, commencing at the date of the injury, within which a legal action has to be brought.

3. Ross v. Butler, 19 N.J. Eq. 294 (1868).

4. Marshall v. Holbrook, 276 Mass. 341, 177 N.E. 504 (1931).

5. Cogswell v. New York, N.H. & H.R. Co., 103 N.Y. 10, 8 N.E. 537, 57 Am. Rep. 701 (1886).

6. William Aldred's Case, 9 Co. 57b, 77 Eng. Rep. 816 (K.B. 1610).

recognized matter that cannot be seen or smelled but can nevertheless seriously impair health.¹ Thus, few instances have been found of recovery for nuisance where the pollution does more than affect one's aesthetic sensibilities. Generally speaking, the courts are not well prepared to proclaim as nuisance those pollutants which affect only health, despite the adverse health effects embodied in air pollution.²

It is important to note that even if the court deals only with aesthetic considerations, a nuisance requires that the interference be "substantial." Thus an aesthetic nuisance in one situation may not be an aesthetic nuisance to another. As knowledge of the health effects of air pollution increases, however, it is reasonable to believe that health damage will come to be recognized as more substantial than is presently acknowledged.³

1. As early as 1883, H. G. Wood, in The Law of Nuisances, (San Francisco: Bancroft-Whitney Company, 1883) indicated the difficulty the courts were having in handling deleterious health effects from air pollution (p. 768).

2. See Paul Rheingold, "Civil Cause of Action for Lung Damage Due to Pollution of Urban Atmosphere," 33 Brooklyn L. Rev. 17 (1966). This article offers some interesting thoughts on showing health damages, but it appears to be of little value to the attorney bringing the action.

3. Two recent articles tend toward this view: Leonard Miller and Doyle Borchers, "Private Lawsuits and Air Pollution Control," 56 A.B.A.J. 465 (1970) and Richard Farrell, "Let the Polluter Beware," 75 Case and Comment 3 (Sept.-Oct., 1970).

Strengthening Private Legal Action

A number of measures are now available or presently contemplated to strengthen private rights and legal remedies in matters of environmental quality. These include: environmental protection legislation, such as the recently passed legislation in Michigan; an environmental Bill of Rights (as presently contemplated in the U. S. Congress and several state legislatures); environmental courts (to parallel specialized adjudicatory bodies for tax matters or customs claims); and an environmental ombudsman (to provide the private citizen with an alternative to court or administrative action).

Environmental Protection Legislation

From the standpoint of promoting private legal action, the most significant environmental protection legislation in recent years has been the 1970 Environmental Protection Act of Michigan.¹ Under the Act, Michigan became the first state in the nation where citizens are specifically granted a right to file suit against anyone to protect the air, water or other natural resources. Conservationists, whose suits have often been dismissed because the courts have ruled that they had no legal standing, have generally agreed

1. The Thomas J. Anderson, Gordon Rockwell Environmental Protection Act of 1970, Act No. 127 of the Michigan Public Acts of 1970, was signed into law by Governor Milliken on July 27, 1970. The Act became effective on October 1, 1970. A second Michigan environmental act, not discussed here, went into effect in March 1971. Known as the Truth in Pollution Act, the legislation will provide private and public parties with much of the information they might need to press environmental suits.

that the Act is a milestone since it would greatly extend the power of private citizens to protect the environment.¹

In addition to its importance for the State of Michigan, the Environmental Protection Act of 1970 has already had a significant influence upon proposed legislation elsewhere in the country. The most obvious example is in the Clean Air Amendments of 1970, which allow citizen suits against polluters or the Administrator of EPA under certain conditions.² Furthermore, Dr. Joseph L. Sax, a professor of law at the University of Michigan who drafted the Michigan legislation, has drafted similar bills, one of which was introduced into the U. S. Senate in the previous Congress.³ In these efforts, the main provisions of the Michigan Act have been incorporated into new legislative proposals with little change. Consequently, the following discussion focuses primarily on the main provisions of the Michigan Environmental Protection Act of 1970.

1. "Ecology Lawsuits Approved in Michigan," New York Times, July 5, 1970.

2. The Clean Air Amendments added a new section 304 which allows private citizens to sue anyone who violates an emission standard. In addition, the Administrator of the Environmental Protection Agency may be sued when he fails to do a non-discretionary duty, which is essentially an action in mandamus (for a deeper discussion of mandamus, see the preceding section in this chapter).

Neither suit can be brought if 60 days notice is not given to the Administrator of EPA. If a polluter is sued, he and his state must also be given 60 days notice. However, there are no notice requirements if the polluter is violating an order of the Administrator requiring compliance with a state implementation plan.

3. The Senate bill, S. 3575 in the 91st Congress, was introduced by Senators Hart and McGovern, but died in the Commerce Committee after having been approved by the Subcommittee on Energy, Natural Resources, and the Environment.

Challenge to Pollution Standards. The most significant provision of the Michigan Act is likely to be Section 2.¹ A major feature of this section is to allow anyone to go to court against any public agency or private industry that is thought to be damaging the environment. Under the Act, and for the first time in environmental matters, a court can declare deficient a standard established by a pollution control agency. The Act allows the court to determine that a standard is either unreasonably high or low. Although the power to lower a standard is not expressly given (as is the power to raise a standard), the court can effectively lower the standard by declaring a standard unreasonably high. The criterion of reasonableness, as indicated earlier in this chapter, is and will continue to be subject to broad interpretation. Consequently, the courts, under the Michigan Act, will continue to play a broad role in determining appropriate standards of environmental quality.

The potential of private suits to challenge pollution standards seems great indeed. Specifically, the suits could have an important effect on agency performance. Court disapproval of an agency's standards, for example, could prompt a re-evaluation by the agency of its standard-setting policy. More frequently, court disapproval could even cause the control agency to lose its public credibility. It is unlikely, however, that judicial attacks on

1. Section 2(2), in part, states that "the court may:

(a) Determine the validity, applicability and reasonableness of [a] standard."

pollution standards would be frequent since the courts generally lack sufficient analytical resources for regular standard review.

By way of conclusion, it should be noted that legal opinion is generally divided as to whether suits by private citizens should be allowed to compel compliance with environmental quality standards. One view is that a pollution control agency best represents the interests of all concerned,¹ and that a polluter should not be subject to individual suits by those who are unrepresentative of the entire public interest. Another view is that the public interest is best served by allowing, indeed encouraging, private suits.

Grant of Legal Standing. At least in the past, citizens who have brought environmental suits have often had them dismissed because the courts have not granted legal standing. As noted above, under the discussion of mandamus, this is the problem of "standing to sue."²

Prior to the 1970 Environmental Protection Act, many environmental suits were dismissed because courts ruled that private citizens did not have proper legal standing and that actions should be brought by local, state or Federal agencies in charge of

1. Garland Grain Company v. D-C Home Owners Improvement Association, 393 S.W. 2d 635, 639-640 (Texas, 1965).

2. An extensive discussion of this problem, as it relates to environmental suits, is contained in a forthcoming issue of Ecology Law Quarterly (scheduled for publication mid-1971). See, "Analysis of the Ramifications of the Michigan Environmental Protection Act of 1970," Ecology Law Quarterly.

protecting the environment. Thus, the citizens of Santa Barbara were unable to file suit against the Department of Interior to prevent the grant of further leases for offshore drilling after a large oil spill covered their beaches last year. A Federal Court of Appeals held that the interests of the citizens were already protected by the Department of Interior.¹

Under the new Michigan law, any citizen of that State may bring suit against a private and/or public party to protect "the air, water, and other natural resources and the public trust therein from pollution, impairment or destruction."² If the interpretation of "public trust" were sufficiently broad, the resulting impact of the bill would be substantial. At the very least, the "standing to sue" problem discussed above is eliminated for public nuisance suits. Thus, for example, the 1970 Environmental Protection Act would not preclude a Michigan court from granting standing, denied in a Federal Court by refusing to allow suit by Santa Barbara citizens.

While the Act essentially allows a private citizen to sue for public nuisance, it does little to aid recovery. The largest stumbling block in private nuisance has been in proving that the defendant's pollution directly caused the plaintiff's injury.³ In

1. County of Santa Barbara v. Hickel, 426 F.2d. 164 (9th Cir. 1970).

2. Michigan Environmental Protection Act of 1970, Section 2(1).

3. "Private Remedies for Water Pollution," 70 Col. L.Rev. 745 (1970).

this connection, the Act does nothing to cure the procedural problems inherent in proving causation.

Prevention of Unfounded Suits. To prevent unfounded cases, Section 2a was added to the Act as originally proposed.¹ Under this section, the Act allows a court to require a plaintiff to post a \$500 bond when the court believes the plaintiff will pay the court costs for which he would be responsible if he loses the case.

At least two possible outcomes of Section 2a are foreseeable at this time. One possible effect of the provision could be to deny the right of recovery to some individuals because of their financial status. In other words, assuming that a plaintiff's claim were valid, he could nevertheless be denied a remedy for the wrong that he had suffered because he could not afford to post the bond.

A second possible outcome is that the \$500 bond may not prove significant enough to deter a flood of lawsuits by private parties.² If this were the case, then Michigan's courts would have to cope with numerous suits under the Act. In this event, the courts must determine how consideration can be limited to meaningful suits. One potential solution lies in Section 4(2) of the Act, to be discussed below, which allows the courts to require parties to

1. This provision is not generally found in the legislation proposed in the Senate. The Federal bill introduced by Senators Hart and McGovern provided for a bond, but only if it would not hinder the plaintiff unreasonably.

2. This opinion was expressed by R. B. Cunningham, Adjunct Professor, George Washington University Law School, August 17, 1970.

seek a solution through the normal administrative process before seeking judicial relief under the Environmental Protection Act.

Basis for Defense. As a defense to a suit brought under the Act, Section 3 requires the defendant to prove that his conduct was consistent with public health and welfare and that there is no feasible, prudent alternative to his conduct. In essence, Section 3 incorporates a balancing test commonly used by courts to deny relief to a plaintiff in spite of damage to him.¹ Hence, if the defendant is able to prove that his interest is of greater importance than the damage to the environment, he may apparently continue his polluting conduct.

A problem with Section 3 is that the language used lends itself to many interpretations. The statutory working is unclear where it allows the defendant to show that his "conduct is consistent with the promotion of the public health, safety and welfare in light of the state's paramount concern for the protection of its natural resources from pollution, impairment or destruction." If this "paramount concern" clause is read literally by the courts, conduct which detrimentally affects natural resources to any degree could be stopped or prevented. The courts are more likely, however, to interpret the clause to mean that the defendant will have to show that his conduct is not inconsistent with public health, safety

1. Harper and James, The Law of Torts (1956), pp. 90-91. The balancing test, which is discussed earlier in this chapter, is a weighing of the value of continued pollution against the damage caused by it.

and welfare--a balancing test similar to that used without environmental protection legislation.

An important element of Section 3 is the requirement that the defendant prove that he had no reasonable alternative and that his emissions do not endanger public welfare. Obviously he cannot be expected to prove that he has explored every conceivable means of controlling his conduct; only that he has made a reasonable attempt to find an alternative less deleterious to the environment. This requirement would enable the courts to ensure that alternative conduct has been considered by the defendant.

Another possible outcome would be for the courts to adopt an alternative standard based on what pollution control practice ought to be rather than on what is the current practice.¹ If an "industry practice" test is used to determine what is "feasible and prudent," polluters would be unduly favored since there is rarely any incentive within an industry to adopt reasonable pollution control practices. For this reason, it could well be important that the courts review standards other than intra-industry practice when considering alternatives to pollution.

Exhaustion of Remedies. Under Section 4 of the Act, the court may order the plaintiff to exhaust his remedies against the defendant in administrative proceedings.² A court is required to

1. "Water Quality Standards in Private Nuisance Actions," 79 Yale L.J. 104 (1969).

2. Michigan Environmental Protection Act, Section 4(2).

hear the dispute only after administrative remedies have been exhausted. Normally, a plaintiff should utilize the regular governmental channels to obtain relief before seeking relief elsewhere. Courts usually require this unless to do so would be futile, for example, where the administrative process is unduly dilatory, meaningless, or incapable of providing an adequate remedy. In the Act, the language is discretionary and a court would not have to require exhaustion.

As discussed earlier under Prevention of Unfounded Suits, Section 4 could be an important tool in allowing the Michigan courts to control the type and number of suits which they hear under the Act. Heretofore in most, if not all, cases where there has not been exhaustion of administrative remedies, the courts have required it. Since an administrative proceeding would determine most of the facts in the case, the courts in future would only need to review these proceedings to insure that the agencies have acted reasonably to protect the public trust and natural resources, rather than to attempt a full-scale rehearing of all pertinent facts.¹ By limiting their review of administrative proceedings, the courts may select those cases where more intensive judicial treatment is necessary.

1. Section 4(3) provides for a court to adjudicate under the Act after administrative proceedings are completed, but this does not require a court to redetermine the facts.

Third Party Intervention. Section 5 provides that any person can be permitted, by a court or administrative agency, to intervene in a governmental "proceeding or action" affecting environmental quality.¹ In the past, there have been many situations in which an agency or court made a decision without regard to the environmental effects of its decision.² In these situations, the agency or court would generally hear only evidence from the plaintiff and defendant, without regard for the effect of their decision on other parties or the environment. The Act changes this by requiring that the court or agency allow third parties to present evidence if the proceeding involves conduct that could affect the environment. It might be noted that Federal agencies generally allow third parties to be heard in administrative proceedings,³ and a similar practice for state and local agencies would seem appropriate.

An additional provision of the Act is that no administrative determination may authorize or approve conduct which will

1. Michigan Environmental Protection Act, Section 5(1).

2. See D. Sive, "Some Thoughts of an Environmental Lawyer in the Wilderness of Administrative Law," 70 Col. L.Rev. 612 (1970).

3. This concept was promoted on the Federal level by Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d 608 (2d Cir. 1965), cert. denied, 384 U.S. 941 (1966). Other significant Federal action in this area includes Executive Order 11514 which requires that Federal agencies enhance the environment in their activities and Section 21(b) of the Federal Water Pollution Control Act, 33 U.S.C. 466, as amended, which requires that Federal Agencies use their permit power to enforce adherence to water quality standards.

impair environmental quality if there is a "feasible and prudent alternative" consistent with "public health, safety and welfare."¹

Since the right of third parties to intervene implies a right to have their evidence considered, this provision follows naturally from the requirement that third parties be allowed to intervene. Moreover, consideration of environmental quality by a court or agency is required, even though no party has intervened to present evidence on the environmental effects of a particular decision.

Prevention of Multiplicity of Suits. To protect against a multiplicity of suits, Section 5 allows a plaintiff or defendant to utilize the legal doctrines of collateral estoppel and res judicata.² The principal use of these doctrines is to defend against a second suit on the same issues. For example, if the state brings a suit under the Act and loses, then the defendant will be able to use the doctrine of res judicata to prevent a private individual suing under the Act for the same alleged wrong. For a plaintiff, use of these measures will mean that he need only show circumstances identical to those of a previously prevailing plaintiff. If these can be shown, then he will be entitled to recover damages without the expense and delay of an extensive trial.

1. Michigan Environmental Protection Act, Section 5(2).

2. Ibid., Section 5(3). Simply stated, res judicata refers to a case already decided by a judicial authority. The doctrine of res judicata is that if a case has been decided already, it cannot be decided again. Similarly in collateral estoppel, a person is prevented from making a claim or defense because it is contrary to a previous claim or defense that he has made.

In sum, use of these doctrines clarifies rights so that parties are less likely to go to court to determine what their rights are.

By allowing use of the doctrines of collateral estoppel and res judicata, the Michigan Environmental Protection Act may raise serious enforcement difficulties. As discussed earlier in the section on Grant of Legal Standing, the Act effectively confers upon a citizen the right to bring suit in the public name, that is to take public nuisance action. For example, if a private citizen sues unsuccessfully for public nuisance, the doctrines of collateral estoppel and res judicata would preclude anyone else, including the state or Federal pollution control authorities, from suing on the same problem.¹ Allowing a private citizen to represent the public may present difficulties since a private citizen is not likely to have as many resources to prosecute as would the state or local pollution control agencies. In addition, it is conceivable that a private citizen would do a poor job of prosecution, thus precluding those who could prosecute more effectively from bringing an action. An apparent solution to this problem, under the Act, would be for the courts to construe liberally the right of intervention.

Environmental Bill of Rights

"Every person has the inalienable right to a decent environment. The United States and every state shall guarantee this right." This is an amendment to the Constitution of the United States of

1. "Nuisance," American Jurisprudence, Vol. 39, Section 128.

America, proposed by Senator Gaylord Nelson on the opening day (January 19, 1970) of the Second Session of the 91st Congress.¹

A primary purpose of the Constitutional amendment, according to the Senator, would be to provide every citizen with a "clear, legal, or explicit Constitutional avenue to protect the sensitivities and well being of himself, his family, or his community from environmental assault."²

The need to establish this environmental right--as well as the means for its protection--in the Constitution, according to Senator Nelson, stems from the historic deficiencies of common law:

. . . in the development of our Anglo-Saxon common law, our protections have traditionally focused on economic or personal injury, with the subordination of other damages that we are finding are just as much a threat to the quality of life.³

He added that:

Although I believe that we must explicitly establish environmental right and protection as a fundamental doctrine of our society, it is clear that any such right, and the terms of its protection, must be enumerated in statutes at the Federal and State level and further defined in the courts.⁴

Short of interpretation in the courts, however, the proposed Constitutional amendment by itself would seem to raise

1. The amendment was proposed under S. J. Resolution 169.

2. Joseph L. Gillman, Jr., "Washington Report," Journal of the Air Pollution Control Association, Vol. 20 (March, 1970), p. 126.

3. Ibid.

4. Ibid.

more issues than it settles. What, for example, would constitute a "decent" environment? Would the right apply to everyone, regardless of his health or where he chose to live? And so forth. Perhaps, in conclusion, it can be said simply that writing a laudable guarantee, backed by the United States, is much easier than living up to it. The concept of an "inalienable right to a decent environment," however, is very new and may yet show fruitful results.

Environmental Courts

As the complexities of environmental contamination become increasingly evident, it is equally clear that environmental litigation should be handled by judges well versed in these matters. An environmental court--whether a specialized court system or an administrative hearings board--would serve this function.

Specialized adjudicatory bodies are appealing when specialized knowledge is needed to adjudicate cases and there is a sufficient number of cases to justify such a body. Under this approach, a specialized court system would hear only specialized environmental cases and would be similar to the U.S. Court of Claims or Customs Court. An administrative hearing board, on the other hand, would be a hearing board within a regulatory commission or Federal agency, such as the Federal Power Commission or the Oil Appeals Board of the Department of the Interior.

Rationale for Specialized Adjudicatory Bodies. Part of the rationale for these and similar arrangements is that a specialized

adjudicatory body can handle problems in a specialized area more effectively than courts of general jurisdiction. The latter, in contrast, tend to handle all problems but master none.¹

Specialized adjudicatory bodies can also contribute to a uniformity of approach. An environmental court, for example, would have a limited number of judges handling pollution problems, rather than every judge in the country establishing his own environmental policy on an ad hoc basis. Without specialized adjudicatory bodies, a uniform approach in all lower courts under the present judicial system would be possible only through time-consuming and expensive appeals to the court of last resort.²

If national uniformity in the present judicial system is desired, then the Supreme Court must consistently agree to hear (in most instances through grant of certiorari) environmental cases. Although public discussion of this possibility is relatively recent, it seems unlikely that the Supreme Court would consistently agree to hear environmental cases. At present, the Supreme Court handles very few cases from each of the hundreds of specialized areas, and to date has considered only a handful of environmental matters. Furthermore, it is generally acknowledged that the Court's time is simply too limited to hear environmental cases consistently in the future.

1. James Landis, The Administrative Process (1938), p. 31.

2. Ibid., p. 33.

An alternative approach to national uniformity in the present judicial system could be provided by a corps of judges handling only environmental cases. The utility of this approach, however, would depend upon the existence of a sufficient number of cases to justify a specialized adjudicatory body. The deciding factor in determining the number of cases is doubtless the approach(es) adopted to control pollution. For example, control approaches which rely upon legal prosecution for enforcement would result in many environmental suits and probably justify a specialized adjudicatory body. In contrast, the present Federal program, which emphasizes cooperation and voluntary compliance,¹ would probably not justify a specialized body, since few suits are filed.²

In addition to the number of suits required on a national basis, the geographic distribution of cases must be taken into account. Where parties must litigate in one location, such as the District of Columbia, there can be severe financial and evidentiary problems, particularly for private parties. In the example above,

1. For further reference see Chapter 3 on Emission Standards.

2. Only one case has been brought to court under the Federal Water Pollution Control Act, the case of United States v. City of St. Joseph, No. 1077, W.D. Mo., October 31, 1961. See "Federal Programs for Water Pollution Control", Legal Control of Water Pollution (1969), U.C.D. L. Rev., 71 at 91. Similarly, only one case has been brought under the Clean Air Act, against a Bishop, Maryland, rendering plant. See Statement of Charles C. Johnson, Jr., Administrator, Environmental Health Service, before the House Subcommittee on Public Health and Welfare, March 5, 1970, on Air Pollution Control, p. 223. Experience in both cases is summarized in the First Annual Report of the Council on Environmental Quality, Environmental Quality (Washington, D. C.: Government Printing Office: August 1970).

witnesses would have to travel to Washington, D. C., and a District lawyer would have to be retained.¹ In such instances, a specialized adjudicatory body would seem to serve justice better by handling the case at the most convenient location.

In addition to the two criteria above, specialized adjudicatory bodies are established when:

1. The courts have not contributed to vigorous enforcement of the law in a field;²
2. Specialized treatment of controversies under particular statutes is desired;³
3. It is considered beneficial for the functions of adjudication and policy formulation to be in the same hands;⁴ or
4. A practical (as opposed to legal) judgment is desired, in which case the adjudicatory body would base its decision on all available considerations in an attempt to achieve the most desirable and pragmatic solution to a particular problem.⁵

With the possible exception of number 3, all of the above apply to both specialized court systems and administrative hearing boards. In principle, at least, only administrative adjudication combines the functions of policy formulation and adjudication in the same body. In much administrative adjudication, however, the policy

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1. This arrangement, in effect, would usually entail retaining two lawyers, one where the case originated and one in Washington, D. C.
 2. Schwartz, Introduction to American Administrative Law (1958), p. 92.
 3. Pres. F. D. Roosevelt, 86 Congressional Record 13942 (1940).
 4. Woll, Administrative Law (1963), p. 182.
 5. James Landis, The Administrative Process (1938), p. 33.

formulation and adjudicatory functions, while lodged in the same overall organization, are actually assigned to separate bodies. Judicial adjudication, on the other hand, would result in a separation of adjudication (the courts) and policy formulation (the administrative agency). Which approach is appropriate entails a judgment as to the advantages and disadvantages of judicial versus administrative adjudication.

Judicial v. Administrative Adjudication. The principal differences between judicial and administrative adjudication can be summarized as follows:

<u>Judicial Adjudication</u>	<u>Administrative Adjudication</u>
1. The judge and jury have no prior knowledge of the case and no policy on the merits.	1. The agency usually has knowledge and a policy. ¹
2. A decision is made immediately upon the conclusion of trial.	2. Decisions are made after a study of the written record. ²
3. A court's sole function is deciding cases brought by outside parties.	3. The appropriate bodies hear cases involving either outside parties or cases in which the agency may be a party. ³

1. Prettyman, Trial by Agency (1959), p. 19.

2. There is no reason, however, why a court cannot make a deliberation after study of the written records, but it is doubtful that a jury could do so. Ibid., p. 19.

3. Schwartz, Introduction to American Administrative Law (1958, p. 79.)

Judicial Adjudication

4. The courts must balance a number of considerations, not just a single statute.

5. Courts are not dependent upon the parties for their support.

6. Subject to appeal. Appellate courts generally attach more weight to judicial adjudication.

7. The courts are limited by the Constitution to a "case or controversy."⁵

Administrative Adjudication

4. The prime aim is to implement a legislative policy embodied in the agency's enabling Acts. Hence a court presumably balances many factors whereas an administrative body may give primary attention to particular pre-established policies.¹

5. Regulatory agencies tend to rely on those regulated by the agency for support. Consequently, administrative adjudication may result in a lack of desire in the agency to offend the group being regulated.²

6. Subject to appeal. Appellate courts are reluctant to reverse administrative adjudication and generally do not review agency decisions made within statutory discretion.³ Appellate courts generally attach less weight to administrative adjudication.⁴

7. The appropriate bodies have wide hearing powers.⁶

1. Amalgamated Util. Workers v. Cons. Edison Co., 309 U.S. 261 (1940).

2. Woll, Administrative Law (1963), p. 180.

3. Ibid.

4. A further consideration, however, is that there is generally less social disapproval attached to being a defendant before an administrative court than before a judicial court.

5. In other words, problems must be actual or "ripe" in a legal sense before courts can consider a problem.

6. Jaffe, Judicial Control of Administrative Action (1965), p. 90.

In summary, two broad conclusions can be made. First, the need for a specialized adjudicatory body is heavily dependent on the number of environmental suits that are brought to court. If the number of suits is large, then a specialized adjudicatory body may be justified. Second, administrative courts function to effectuate broad social goals better than judicial courts, even a specialized court system. A goal of uniform, nation-wide environmental quality, therefore, would seem best served by an administrative adjudicatory body, although either body would improve the administration of justice.

Environmental Ombudsman¹

An ombudsman is an impartial third party who stands as mediator and intervenor on behalf of a citizen complaining about a governmental action. In the field of air pollution, it is recognized that municipal governments are often administrators of many activities that contribute to pollution. Although court action is available to an injured party, even when the municipal government is carrying on a lawful activity,² it is often argued that a quicker, less antagonistic means of resolving the conflict would be to

1. See generally, Lance Tibbles, "Ombudsmen for Local Government--the Buffalo Experiment", 2 Urban Lawyer 364 (1970) and William Rodgers, "When Seattle Citizens Complain," 2 Urban Lawyer 386 (1970).

2. For an instance where a municipal dump is held a nuisance, see Greer v. Lennox, 79 S. Dak. 28, 107 N.W. 2d 337 (1961). Also, Miami v. Coral Gables, No. 69-1006, March 10, 1970, where Miami's municipal incinerator was held both a public and a private nuisance.

interpose the ombudsman between the municipality and the citizen. This concept is in its infancy in this country and may show promise, although its effectiveness in environmental situations is as yet untested.

Summary and Conclusions

Private legal action is available to obtain relief from air pollution. What is more, recourse to the legal process is becoming increasingly feasible with the passage of anti-pollution legislation such as the 1970 Michigan Environmental Protection Act. At the same time, however, private legal action as an overall approach to pollution control suffers from a number of defects.

Limitations of Rights

In obtaining relief from pollution, the rights of private citizens--whether based on nuisance, trespass, negligence or other legal theories--are subject to many limitations. As detailed above, for example, a citizen may easily lose his case on grounds such as "coming to the nuisance" or the existence of a prescriptive right. Furthermore, since actual physical damage to the plaintiff must be shown, it is extremely difficult to recover for pollution damages to health, aesthetics or recreation.

Besides these limitations, there are other hurdles. The plaintiff must prove, for example, that the defendant's emission was the cause of the damage done. In addition, many environmental suits are regularly thrown out of court on the ground that only governmental

bodies have legal standing to sue for conduct broadly affecting all citizens.

Limitations of Remedies

Even if it can be established that a private citizen's right has been violated, difficulties are encountered in obtaining appropriate relief. The most frequent problem is the balancing test used by many courts, in which the benefits and costs to plaintiff and polluter are evaluated, frequently without regard to pollution damage to society as a whole. What is more, should the plaintiff lose in the balancing test, he may be denied effective relief.

Deficiencies in the Judicial System

In addition to these limitations, there are three basic defects in the judicial system that are often overlooked: the procedural problems, the inconsistent results, and the inability of the courts to handle large numbers of claims. When a decision is made to use a particular pollution control approach, it is extremely important that these deficiencies be recognized, or else the legal system may not be able to cope with the demands placed upon it.

Procedural Problems. Because of various procedural difficulties, the legal process is cumbersome at best. From the standpoint of the private citizen, the legal process is expensive in both time and money. Because of the large number of parties damaged from most air pollution, it is frequently difficult to bring suit for the damages of all injured parties. Furthermore, organizing action

among all damaged parties is both difficult and costly. Often organized groups claiming damage are thrown out of court because the courts find that they lack standing. Further compounding these difficulties is the frequent judicial attitude that health and aesthetic damages are too speculative and cannot be recovered. Other problems occur with sovereign immunity and the statute of limitations.

Inconsistency. From the standpoint of equity, the courts provide very inconsistent adjudication in controlling pollution. Legal standards applied by courts--such as "reasonable" or "substantial"--are extremely vague, and hence may be applied to suit the temperament of the particular court. As a result, private legal action is probably less equitable than some other approaches for a broad range of pollution control problems. Even with a specialized adjudicatory body there is little overall planning and coordination in the judicial system, because each case deals with specific problems, rather than with larger policy perspectives.

Inability to Handle Large Number of Cases. Frequently, laws are passed without regard to the ability of the courts to handle them.¹ Any system of pollution control must allow for capabilities of the courts or risk being unenforceable. For example, the Federal Coal Mine Health and Safety Act of 1969 was passed without regard to the manpower requirements needed to enforce

1. Chief Justice Burger, "State of the Judiciary," American Bar Association Convention, St. Louis, August 10, 1970.

the act, either at the inspection level or the judicial level.¹ Consequently, the requirements of the act have been neglected by many mine owners. Similar problems can be expected for any approach to pollution control which relies heavily upon the judicial process.

Another problem that must be anticipated is a flood of suits when significant new legislation requiring enforcement is enacted. When the Coal Mine Safety Act became effective, there was a landslide of cases, largely because the mine owners were unsure of the meaning of the new law. Now that the owners know exactly what the act requires,² the number of cases has fallen. Even though there may not be long-term difficulties with a new law, it is important to plan for a flood of cases when the law becomes initially effective. If the cases cannot be handled, the law may be severely weakened.

Thus, it is important to understand the capabilities of the legal system in developing a pollution control approach. Furthermore, it is important to recognize that recourse to private legal action does not necessarily encourage continuing pollution control. Once a polluter has paid permanent damages, there is no motivation either to continue the abatement or to find a better method of control.

Role of Private Legal Action

Despite the defects discussed above, private legal action is very important in its role as a supplement to other pollution

1. Information obtained in discussions with the Office of the Solicitor, Mine Health and Safety, Dept. of the Interior, February 26, 1971.

2. Ibid. The mine owners sued to enjoin enforcement on the grounds that the law was vague and imprecise. The first few cases determined the law's meaning, however, thus removing the basis for subsequent suits.

control approaches.¹ It is a means of controlling pollutants not covered by existing standards or form of regulation.² It is also important as a means of filling other gaps in the regulatory structure, for example, those created when the regulatory body cannot or will not enforce the law against a polluter.³ An obvious example is the case where the damage from a polluter is not widespread. An agency with a limited budget might not consider the polluter significant enough to bring to court, whereas suits by private parties could solve the problem. Use of private legal action here could relieve pressures on government officials, as well as speed abatement action.

Flexibility can be introduced into a pollution control scheme by private legal action, which can insure that requirements are not being too rigidly applied to particular individuals.⁴ On the other hand, a private suit can also protect individuals against inequitable application of pollution control requirements by ensuring that the same treatment is afforded to all parties with the same circumstances.

Another purpose of private legal action could be not as an integral part of the enforcement process, but as a method for

1. "Private Remedies for Water Pollution," 70 Col. L.R. 755 (1970).

2. "Equity and the Eco-System: Can Injunctions Clear the Air?" 68 Mich. L. Rev. 1254 (1970) at 1260.

3. Ibid.

4. Leonard A. Miller and Doyle J. Borchers, "Private Lawsuits and Air Pollution Control," 56 A.B.A.J. 465 (1970).

highlighting the need for action.¹ In the sense of developing issues and pressing for solution, private legal action can play a valuable role in bringing attention to environmental issues which have been neglected--by legislators, pollution control agency administrators, and the public at large.

Present Promising Proposals

In addition to playing a supplementary role, private legal action could be strengthened to deal more directly with air pollution problems. However, of all the present proposals to strengthen private legal action, only the environmental protection legislation offers any significant improvement for the private citizen. Environmental courts and environmental ombudsmen would facilitate relief under the present judicial system, but would not affect the private individual's rights or remedies in any basic way. Environmental courts, for example, would give more consistent and reasoned decisions on environmental matters, but their establishment would not make stronger rights or remedies available. While an Environmental Bill of Rights purports to change the existing environmental rights, the constitutional amendment currently proposed produces more problems than it solves, particularly with regard to what rights are being given to whom. Furthermore, it is not clear that an

1. As indicated earlier in this chapter, this suggestion has been made by Leonard A. Miller and Doyle J. Borchers in "The Role of the Private Lawsuit in Air Pollution Control: Speculations on Court Usage of Government Materials," paper presented at the Annual Meeting of the Air Pollution Control Association, New York, New York (June 22-26, 1969), p. 1.

Environmental Bill of Rights would significantly change the current state of private legal rights and remedies.

The model for most currently contemplated environmental protection legislation is the Michigan Environmental Protection Act. It would seem from the above analysis (see Environmental Protection Legislation), however, that advocates of the Michigan Act are inclined to be overly enthusiastic about the results that it will produce. The Act does give the private citizen more power to play a role in preserving or improving his environment. But it is doubtful if the courts are as eager to take control of environmental protection as advocates of the Act would hope. Based on past experience, the courts generally require only that administrative agencies act reasonably. Consequently, the standards set by pollution control agencies in Michigan are not likely to be successfully attacked very often. Furthermore, courts have neither the expertise nor the time to set standards on a broad scale. And finally, a balancing test is incorporated into the Act and it is likely that courts will continue to favor commercial and domestic uses of air which are clearly discernible rather than aesthetic, recreational, and health values which are not so easily determined.

The Michigan Environmental Protection Act is a victory for environmental quality, but many more dramatic battles are yet to be fought, let alone won. The Act only allows the private citizen to play a larger role under the existing approaches to pollution control. It does not alter private legal action or existing pollution control policies in a basic way. Furthermore, unless more resources

by pollution control agencies are brought to bear, a private citizen's successfully prosecuted environmental lawsuit may turn out to be but a Pyrrhic victory.¹

Probably the most significant provisions of the Michigan Environmental Protection Act are those which facilitate private legal action against public officials. Under the Act, for example, a court can declare deficient an ambient air standard established by a pollution control agency. Similar provisions have also been incorporated in the Clean Air Amendments of 1970 (see Chapter 1), which permit private legal action against the Environmental Protection Agency Administrator when he fails to carry out a non-discretionary duty. Such provisions are essentially an extension of mandamus, as discussed in an earlier section of this chapter.

Almost all of the most publicized environmental suits in recent years have been based upon the alleged failure of government to adhere to statutory requirements. Examples are the suits against the Federal Trade Commission and the Secretary of the Interior.² The air pollution control potential of private legal action against public officials seems significant under recent statutes, but is beyond the

1. As Harry Hall, President of the Michigan Chamber of Commerce, remarked, "People who think this law in itself will stop pollution will be disappointed." Detroit News, July 28, 1970.

2. Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F. 2d 608 (2d Cir. 1965); Sierra Club v. Hickel, 433 F. 2d 24, (9th Cir. 1970), certiorari granted ___ U.S. ___ (1971).

scope of this report.¹ Nevertheless, the relevant provisions of two recent federal laws should be mentioned in passing, particularly since air pollution control in some circumstances may depend upon the degree to which public officials can be legally compelled to complete their statutory obligations.

The first federal statute to substantially expand the arena for private legal action against public officials on environmental matters was the National Environmental Protection Act of 1969.² The Act declares that "all agencies of the Federal Government" shall build environmental considerations into their policy planning and shall prepare reports on the likely environmental impact of proposed legislation and action. There are three kinds of reports which are required from departments and agencies under the Act: (1) environmental impact statements, which are to accompany every proposed action or piece of legislation and are to evaluate immediate and long-term environmental effects and to propose alternatives whenever possible; (2) internal procedures statements, which are to develop regulations whereby agencies and departments will automatically consider environmental effects along with economic and technical considerations; and (3) statutory review statements, which are to

1. As used in this chapter, "private legal action" refers primarily to private suits against private sector polluters. Accordingly, the possibility of private suits against public officials (e.g., mandamus) is dwelled upon only briefly. Other chapters (in particular, Chapters 3 and 10) discuss legal action brought by governmental agencies in enforcing air pollution control programs.

2. 83 Stat. 852, Section 102(c).

include a review of the office's present statutory authority and administrative regulations, with recommendations to make them consistent with the National Environmental Policy Act. Potentially, the failure to complete any of these reports could be subject for an environmental suit. The second federal statute to substantially expand the arena for private legal action against public officials was the Clean Air Amendments of 1970,¹ which permit private citizens to sue the EPA Administrator. These provisions in both pieces of legislation, although they are outside the scope of this report, are certain to play an increasingly important role in pollution control over the coming years.

1. P.L. 91-604, 84 Stat. 1676. For a discussion of the Clean Air Amendments of 1970, see Chapter 1.

CHAPTER 6

COST SHARING

At the present time there are a number of Federal, state and local provisions that subsidize industry's cost of controlling pollution. Included are accelerated depreciation, investment tax credits, tax exemptions, government loans and loan guarantees, and direct aid in the form of grants and technical assistance.¹ It has been estimated that these provisions give government assistance to

1. Cost sharing arrangements such as these have been discussed extensively in books, articles, reports of governments committees, task forces and other bodies and hearings. The following documents, listed in chronological order, would serve as useful additional references for the interested reader:

The Institute of Public Administration. "Industrial Incentives for Water Pollution Abatement," A Report to the U.S. Department of Health, Education, and Welfare, Washington, D.C., 1965. (Mimeographed.)

ABT Associates, Inc. "Incentives to Industry for Water Pollution Control: Policy Considerations," A Report to the Federal Water Pollution Control Administration, Washington, D.C., 1967.

Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised). "Cost Sharing with Industry?" Washington, D.C., 1967. (Mimeographed.)

Paul H. Gerhardt. "Incentives to Air Pollution Control," Law and Contemporary Problems, Vol. 33, No. 2 (1968).

Richard D. Wilson and David W. Minnotte. "Government/Industry Cost Sharing for Air Pollution Control," Journal of Air Pollution Control Association, Vol. 19 (October, 1969).

Douglas B. Wilson. "Tax Assistance and Environmental Pollution," Tax Policy, Vol. 37, No. 7-8 (1970).

Arnold W. Reitze and Glenn Reitze. "Tax Incentives Don't Stop Pollution," American Bar Association Journal, Vol. 57 (February, 1971).

industry amounting to as much as 59 percent of the cost of air pollution control.¹

The purpose of the subsidies considered in this chapter is to encourage firms to install equipment for air pollution control. In this sense, cost sharing arrangements are incentives for air pollution control. However, industry must obviously pay for the equipment. This necessity is a disincentive to control air pollution. There are few incentives other than government subsidies (reduced need for painting may be one of the few) since expenditures on equipment for air pollution control do not result in increased revenues. Consequently, the disincentives (cost of the equipment) are likely to outweigh the incentives (government subsidies) and firms will not be encouraged to abate.²

In other words, the defining characteristic of these cost sharing arrangements is that they do not provide a net incentive to industry. Consider, for example, the numerous bills that have been introduced in Congress to give additional government aid to industry in the form of special across-the-board tax allowances for equipment

1. Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), p. 761.

2. Where wastes have significant financial value, the analysis is different. Subsidies such as accelerated depreciation may tip the scales to profitability; an example of this latter situation is given in the Resource Recovery Act of 1970 (P.L. 91-512—amendments to the Solid Waste Disposal Act). The Administrator of the Environmental Protection Agency is mandated to "carry out an investigation and study to determine. . . recommended incentives (including Federal grants, loans, and other assistance) and disincentives to accelerate the reclamation or recycling of materials from solid wastes, with special emphasis on motor vehicle hulks. . ." It is only with the additional revenue from valuable by-products that cost sharing is effective; this is rarely the case for air pollution.

for controlling air pollution. A typical bill of this type would result in the government bearing an additional 11 percent of these costs.¹ Consequently, this provision, and others similar to it, would reduce the loss to industry of equipment for pollution control, but would by no means make the equipment profitable.

Despite the fact that cost subsidies do not provide a decisive incentive to industry for pollution control, there is tremendous support for these devices (as is the case for almost any subsidy) in government and industry. In fact, aside from the interest in direct regulation as a means of achieving air quality, most political attention and support in the United States, particularly in Congress, has focused on subsidies in the form of depreciation allowances, investment tax credits and the like. The 1966 Report of the Governors outlines the history of support in Congress for tax incentives:

Proposals to stimulate abatement of industrial water pollution through direct incentives have been made since at least 1938, when the 75th Congress approved a bill (H.R. 2711, 75th Cong.) to provide loans and grants to industry for abatement of pollution. However, President Roosevelt vetoed the bill because it contained a provision under which appropriation requests could be made to Congress by the executive agencies without clearing them through the Budget Bureau. A recent study by the Legislative Reference Service, made at this committee's request, indicates that from 1945 to March 1, 1966, at least 84 bills have been introduced in Congress to stimulate construction of industrial pollution control facilities through

1. Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), p. 761.

various forms of Federal tax incentives. Most of these bills provide for accelerated depreciation or investment tax credit.¹

Each year a number of bills continue to be introduced in Congress that would give Federal assistance to firms installing equipment for pollution control equipment. Moreover, several states have passed similar legislation and many more are considering it.² Finally, the Federal Government and some state governments have programs of direct grants and technical assistance for capital and/or operation and maintenance costs incurred in pollution prevention, abatement and control.

The present chapter will discuss the advantages, disadvantages and special problems of these cost sharing arrangements, including: accelerated depreciation, investment tax credits, tax exemptions, government loans and loan guarantees, and direct aid in the form of grants and technical assistance.³

1. U.S., Congress, House, Committee on Government Operations, Views of the Governors on Tax Incentives and Effluent Charges, H. Rept. 1330, 89th Cong., 2d sess., 1966.

2. According to another source, ". . . several thousand bills pertaining to pollution control have been introduced in Congress and state legislatures during the past several years. Many of them offer little to control pollution; rather they extend tax incentives as rewards to polluters. Arnold W. Reitze and Glenn Reitze, "Tax Incentives Don't Stop Pollution," American Bar Association Journal, Vol. 57 (February, 1971).

3. Strictly speaking, the Federal and state corporate income tax provisions amount to a substantial subsidy, in that expenses for air pollution control equipment and operation can be deducted from taxable income. Consequently, profitable firms will find approximately half the cost of air pollution control equipment covered by tax rebates. However, the income tax provisions obviously are not policy variables as far as pollution control is concerned; hence further discussion in the text is not justified.

Accelerated Depreciation

Accelerated depreciation (also referred to as depreciation allowances, rapid write-offs or accelerated amortization) is allowed by the Internal Revenue Service for capital equipment expenditures such as those for air pollution control. Because most firms used accelerated rather than straight-line depreciation for tax purposes, the difference acts as an interest-free loan to the firm. Since, under usual tax provisions, depreciation can take place only over the lifetime of a given facility, this method can be considered effective only for facilities with a life span of more than five years. Accelerated depreciation is presently available in various forms at both Federal and state levels.

Federal Role

The Tax Reform Act of 1969 allows accelerated depreciation for specified facilities for the control of air or water pollution.¹ The Act provides that, in lieu of depreciation, a certified pollution control facility may be amortized over a 60-month period. In order to be certified, a facility must meet the following requirements:

1. It must be a new, identifiable treatment facility used exclusively to abate or control water or atmospheric pollution or contamination by removing, altering, disposing, or storing of pollutants, contaminants, wastes, or heat.
2. It must be used in connection with a plant or other property that was in operation before January 1, 1969.

1. P.L. 91-172, section 704(a) corresponds to section 169 of the Internal Revenue Code.

3. The property must either have been acquired by the corporation after December 31, 1968, or its construction or erection must have been completed after that date. If construction began prior to December 31, 1968, only the portion constructed after that date may be certified.

4. It must be certified by a state certifying authority as having been constructed, reconstructed, or acquired in conformity with a state program for the abatement or control of water or atmospheric pollution or contamination.

5. Facilities for the control of water pollution must also be certified by the Secretary of the Interior, while air pollution control facilities must be certified by the Secretary of Health, Education, and Welfare.

It is important to note that accelerated depreciation under the Tax Reform Act of 1969 is subject to four general restrictions. First, if the facility has a useful life in excess of 15 years, the amount certified would be limited to that portion of the cost of the facility which could be recovered using non-accelerated depreciation methods during the first 15 years of the asset's life. Second, any facility for which an investment credit¹ was claimed will not be certified for this amortization. Third, a facility will not be certified if its cost appears likely to be recovered over the property's useful life through profits from recovery of waste or otherwise. Finally, the special amortization will not apply to a building or its structural components unless the building is used exclusively as a treatment facility.

In an alternative proposal, Senator Byrd of West Virginia has introduced an amendment to the Internal Revenue Code of 1954

1. See following section on investment tax credits.

(S702, 91st Congress) to encourage the abatement of water and air pollution by permitting amortization for income tax purposes of the cost of abatement works over a period of 36 months.

Yet another proposal, supported by Senator Cotton of New Hampshire and 21 other senators, suggests that expenditures on air and water pollution control be treated as current expenses. This Bill, S. 1942, was introduced in the 91st Congress, to provide a 20 percent investment tax credit, as well as allowing capital expenditure on air and water pollution abatement facilities to be deducted either as current expenditures, or over a one- to five-year amortization period, at the owner's option. The combination represents a very generous subsidy for pollution abatement--if the expensing option were combined with the 20 percent tax credit, a firm would pay only about 30 percent of the cost of the facility.

State Role

In addition to Federal Government provisions for accelerated depreciation, this method has also been applied to state corporate income taxes. Several states, including California, North Carolina, Virginia and Wisconsin provide for accelerated depreciation with a five-year write-off period. Because of the particularly weak incentive effects of the subsidy involved, the study has not explored the details of individual state programs.

Extent of Subsidy

The following table illustrates the value of the rapid amortization provisions in Federal tax legislation to larger corporations:

Table 6-1**PRESENT VALUE OF TAX REDUCTION PER \$1000 INVESTMENT¹**

Time Period for Accelerated Depreciation	Cost of Capital		
	5%	10%	15%
<u>50% Federal Corporate Tax Rate</u>			
5 year	\$432	\$386	\$343
15 year	<u>\$346</u>	<u>\$256</u>	<u>\$197</u>
Advantage of Accelerated Depreciation	\$ 86	\$130	\$146
Advantage as % of Facility Cost	9%	13%	15%
<u>25% Federal Corporate Tax Rate</u>			
Advantage of Accelerated Depreciation	\$ 43	\$ 65	\$ 73
Advantage as % of Facility Cost	4%	7%	7%

1. Accelerated depreciation can take various forms, but for discussion purposes we assume:

1. The 60 month write-off period authorized in most Federal and state legislation;
2. Federal corporate income tax marginal rates of 50 percent and 25 percent.
3. A certifiable facility whose normal amortization period is 15 years, the maximum difference allowed by the Federal Tax Reform Act; and
4. Straight line amortization.

The government subsidy to a firm depends upon that firm's internal rate of return. Under the 15-year straight-line depreciation scheme, $1/15$ th of the value of the facility could be deducted from income each year. Assuming a large enough profit, the firm would, in effect, regain in the form of reduced taxes $1/2$ this amount or $1/30$ th the value of the facility in each of the 15 years. Alternatively, with the authorized accelerated depreciation, the gain in each of the first 5 years would be $1/10$ th the value of the facility. It is, of course, the cost of capital that makes accelerated depreciation so popular with industry. There would be no difference to the firm in total tax refunds obtainable in either case; in each instance the firm would obtain one-half the cost of the pollution control facility. Table 6-1 illustrates that it is the timing of tax refunds that is important. The faster the firm can apply for tax refunds, the more profitable is the operation.

Table 6-1 also shows that as the cost of capital rises, so does the value of accelerated depreciation, particularly for large corporations. However, the example also indicates that even the largest possible gain to a corporation--a 15-year write-off reduced to 5 years--is relatively small, since even at a 15 percent cost of capital the amount of subsidy to a firm is less than 15 percent of the initial outlay for the facility.

For smaller corporations, the advantage is even less. For those firms with a marginal Federal income tax rate of about 25 percent, or annual revenues of less than \$25,000, the subsidy is less than half that for the more profitable firms.

Accelerated depreciation at the state level results in an even smaller subsidy as a percentage of the cost of the facility. If the marginal rate of corporate income tax at the state level were as high as 10 percent (higher than current practice in most jurisdictions), a firm with a 15 percent cost of capital would obtain a subsidy of only about 3 percent.¹ But since state corporation taxes may be deducted from taxable income at the Federal level, the effect is cut by half (only 1-1/2 percent for the 15 percent cost-of-capital firm). On review, there is a strong impression that states may have been induced to adopt such cost sharing programs as accelerated depreciation under the mistaken belief that they were providing a significant impetus to air and water pollution control.

Cost to Industry

For individual firms, the increased paperwork and inspections associated with accelerated depreciation often more than offset the value of the subsidy, which is no more than 10 to 15 percent of the capital cost of the installation, with no coverage for maintenance and repairs. Added administrative burdens may make many smaller firms (i.e., those paying taxes at the lower marginal Federal corporate tax rate) particularly hesitant to apply since for them the subsidy is less than half the subsidy for larger firms.

1. Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), p. 763 indicate that state income taxes on corporate profits range from 2 to 9 percent, and average about 5.5 percent. This, strictly speaking, represents a subsidy of 2.75 percent (since tax payments are deducted from Federal taxable income) similar to that for Federal taxes. The advantages cited above are in addition to this 2.75 percent.

In addition, the tax incentives are often offset by higher operating costs, which marginal firms cannot afford to absorb. Consequently, only larger corporations investing in new facilities may find it worthwhile to consider the tax consequences of air pollution control installations. What is more, large organizations such as utilities that can readily identify the additional operating costs of air pollution control, and can share such cost increases with customers, suppliers and/or equity holders without loss of market position, are more apt to take advantage of accelerated depreciation.¹

Cost to Government

It should be noted that accelerated depreciation changes the timing, but not the amount, of government tax reductions. Therefore, the effect of accelerated depreciation can be compared to an interest-free loan given by the government to private industry.²

Consider the example used in Table 6-1. If the cost of capital to the government is 5 percent, then the present value cost is the same as advantage accruing to a firm whose cost of capital is also 5 percent. Thus the legislation, for the particular example, would cost the government \$86 per \$1,000 investment.

1. A number of experiences are described by Institute of Public Administration, "Industrial Incentives for Water Pollution Abatement," Report to the U.S. Department of Health, Education, and Welfare, Washington, D.C., February, 1965. (Mimeographed.)

2. Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), p. 762.

If the cost of capital for the firm is higher than for the government, the advantage to the firm is greater than the cost to the government. If the firm has a 15 percent cost of capital, while the government has 5 percent, the firm's gain, \$146, outweighs the government's loss, \$86; this can be interpreted as a net gain to society as a whole of \$60 per \$1,000 of investment. The difference in cost of capital, of course, presumes a significantly imperfect capital market.¹

The situation is more complicated at the state level but the same general situation holds: if the cost of capital to the firm is higher than to the government, the difference in costs represents a real gain to society.

However, at the state level, the loss of state revenue is greater than the gain to the taxpayer, who can deduct because of state taxes from his federally taxable income. In other words, a concession by the state which costs the state \$100 in revenues will save the taxpayer at best only \$50, assuming it is a corporation subject to the 50 percent rate.

Finally, the cost to states of borrowing usually reflects tax exemptions by the various levels of government on the interest payments of at least some of its bonds. Consequently, the true

1. This potential advantage of cost sharing should not be given much weight. If an imperfect capital market exists, it will likely be most extreme for firms which are small and have low profits. It is precisely these firms which benefit from the preferential Federal corporate tax rate, and therefore these firms would have least scope for gains through faster tax refunds.

difference in cost of capital between the state governments and private firms is less than appears from a simple comparison of interest rates.

Investment Tax Credits

An investment tax credit of 7 percent was allowed by the Federal Government on capital expenditures until October 9, 1966. On that date, Public Law 89-800 came into effect, repealing the tax credit for almost all categories of capital expenditure. Among the exceptions were investment in facilities for air and water abatement. The repeal proved unsuccessful; and the 7 percent tax credit was reinstated May 24, 1967. (P.L. 90-26).¹ Two years later, as an anti-inflation measure, the tax credit was again repealed, this time without exceptions.²

An investment tax credit may be most directly compared to a subsidy. The firm may deduct 7 percent of the cost of the equipment from its taxes, thus providing a subsidy for the purchase of capital equipment. A variety of bills have been introduced at both the Federal and state levels to increase the tax credit to promote

1. According to Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), p. 766, during this period only 23 applications for tax credits from 10 firms were received.

2. P.L. 91-172, effective April 18, 1969.

social benefits.¹ Facilities for the abatement of air and water pollution have been the subject of a number of such bills.

Federal Role

Typical of tax credit proposals constantly before Congress was the amendment to the Revenue Act of 1964 for an increased investment tax credit to encourage construction of pollution treatment facilities by doubling existing tax credit. Initial impetus for the amendment had come from the American Municipal Association,² and a proposal was introduced by Senator Ribicoff on the Senate floor on February 7, 1964. It was offered as an amendment to H.R. 8363 (88th Congress), the omnibus tax bill, on behalf of himself and nine other senators.³

Under the proposed amendment the credit would be increased to 14 percent for purchases of air and water pollution control equipment. The Ribicoff amendment nearly became law as part of the Revenue Act of 1964. However, although it was agreed to by the Senate, the amendment was dropped in conference.

1. In one of the more interesting of recent proposals, Representative Pucinski has introduced a bill (91st sess., H.R. 17,882) which has been sent to the House Ways and Means Committee to amend the Internal Revenue Code of 1954 to allow an amortization deduction for noise abatement devices.

2. Institute of Public Administration, "Industrial Incentives for Water Pollution Abatement," Report to the U.S. Department of Health, Education, and Welfare, Washington, D.C., February, 1965. (Mimeographed.)

3. Senator Hart stated he was the original sponsor of the amendment. The other co-sponsors were Senators Muskie, McIntyre, Engle, Javits, Keating, Pastore, Bartless, Saltonstall, and Pell.

Nevertheless, legislation of this kind still has considerable appeal and is actively supported, particularly by industries which must expend substantial amounts on pollution prevention and control. The chemical industry, for example, indicates that several hundred million dollars have been invested in facilities for air and water pollution control. Moreover, to support and maintain the facilities the chemical industry says it is spending annually over \$100 million.¹

It is not surprising then, that John T. Connor, chairman of Allied Chemical Corporation, backs a Federal tax credit proposal. Noting that pollution control is a vast and complex problem involving not only industry but also Federal, state and municipal governments, he pointed out that industry had already spent "staggering amounts of money" on pollution control. Consequently, "it seems only fair to ask government to share the financial burden of the partnership, in view of the fact that the pollution problem was ignored for so many years in the national effort for economic development."

This interest on the part of industry has continued to receive support in Congress. Reference has already been made to Senator Cotton's Bill S.1942. The accelerated depreciation provisions of this bill have been considered; in this section the major details of the proposed tax credit procedures will be considered. The bill would allow a 20 percent tax credit for expenditures paid

1. Al Wyss, "Action Urged on Tax Credits to Meet Mounting Pollution Expenditures," Journal of Commerce, May 13, 1969, p. 3.

or incurred by the taxpayer during the taxable year for the construction, reconstruction, erection, installation, or acquisition of any facility for water or air pollution control. For a facility for air pollution control, the credit would be available only if the taxpayer obtains a certificate or statement from the appropriate state agency that such facility is in conformity with the state program or requirements for control of air pollution, in compliance with the regulations of the applicable Federal agency and the general policies of the United States for cooperation with the states in the prevention and abatement of air pollution under the Clear Air Act (42 U.S.C. 1857 et seq.).

State Role

As in the case of accelerated depreciation, the investment tax credit device has been applied in a number of states, of which Oregon is typical. Under Oregon law the taxpayer claiming credit for an air pollution control facility is offered several options:

1. A credit against state income taxes of up to five percent of the cost of the facility in any one tax year (not to exceed the tax liability of the taxpayer), with a maximum credit of 50 percent of the cost of the facility. The credit is in lieu of any depreciation or amortization deduction for the facility.
2. A credit against corporation excise taxes (manufacture, sale, use or licensing taxes) of up to five percent of the cost of the facility in any one tax year, up to 50 percent of its total cost.
3. Complete exemption from ad valorem taxes.
4. Tax credits not used in one tax year can be carried forward and offset against the taxpayer's tax liability for the succeeding year.

Extent of Subsidy

The effect of a tax credit is much the same as an opportunity to purchase the equipment at a lower price. The firm would be permitted to reduce the tax paid to the Federal Government by an amount which is 20 percent (for the Cotton bill) of its expenditure on equipment for the abatement of pollution; of course, not every firm is able to take advantage of the provision because the amount of taxes owed the government may be less than the credit allowed.¹

According to Wilson and Minnotte, "Raising the investment credit to 20 percent would give additional assistance amounting to 7.0 percent of the total cost incurred in air pollution control. . . . Allowing a firm to depreciate equipment in one year would result in additional assistance of 4.4 percent."²

As for state legislation on tax credits, the benefits are even smaller. The Oregon proposal limits the tax credit to five percent of the value of the equipment; when changes in Federal tax liability are taken into consideration, firms would recover a miniscule proportion of the cost of pollution abatement equipment.

Cost to Industry

Many of the same arguments made concerning the cost to industry of benefiting from legislation authorizing accelerated

1. This is particularly true of new firms with small taxable incomes, and of firms that have incurred losses. If the amount of the credit exceeds certain statutory limits, the excess credit cannot be taken in the first year; it must be applied in other years.

2. Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), p. 765.

depreciation apply equally to tax credit provisions. Firms must still meet operating, maintenance, and repair costs, with no special subsidy from government, and they must still combat a complicated array of forms and procedures before obtaining the tax credits.

But one advantage of the tax credit scheme is that the accounting changes need be made only on a one time basis--the credit is for the initial year only, and after that time interest of the IRS diminishes.

Cost to Government

Since there is no time dimension involved, the cost to government is essentially the same as the benefit to the company: no benefits occur as previously described involving government risk-taking, or being able to provide low cost "loans" as in the accelerated depreciation case. However, administrative costs of a tax credit are likely to be less than for accelerated depreciation, for the same reasons that the cost of compliance is less for industry.

Tax Exemptions

In addition to the principal forms of cost sharing arrangements discussed above, a number of minor provisions are either contemplated or already available at the Federal, state and local levels. They would exempt equipment for the control of pollution from personal income taxes, property taxes, sales and excise taxes, or from some combination thereof. However, the extent to which the overall effect of these provisions would increase government share

of the cost of pollution control equipment is so limited that they are not analyzed individually here.

Personal Income Tax Exemption

At the present time, the Internal Revenue Service does not allow a personal income tax exemption for individual expenditures on pollution control. However, under a bill (S.3772, 91st Congress) introduced by Senator Byrd of West Virginia, an individual taxpayer would be allowed to deduct from gross taxable income the cost of eligible pollution control equipment. The effect of this bill would vary depending on the individual's tax rate, but even if the rate were as high as 80 percent, the value in dollars would be only \$40 per year, since the maximum deduction established by the bill cannot exceed \$50. For most individual taxpayers, therefore, the benefit will not be large enough to justify inclusion in tax legislation. Moreover, any incentive effect of the proposal would be biased towards capital intensive methods of pollution control, for example, using specific devices on cars rather than changing fuels or retuning the engine. This would lower the value of the exemption even more.

Property Tax Exemptions¹

The largest source of local revenue is the property tax, which accounts for 87.7 percent of local tax revenues. In 1961, property tax collections were \$18 billion, of which \$17 billion went

1. This section draws heavily on Institute of Public Administration, "Industrial Incentives for Water Pollution Abatement," Report to the U.S. Department of Health, Education, and Welfare, Washington, D.C., February, 1965. (Mimeographed.)

to local governments and \$0.6 billion, or 3.5 percent, went to the state governments.¹

Eight states provide exemption from property taxes for property acquired by firms for purposes of air or water pollution abatement, but there is little uniformity in defining taxable property. A 1961 study of the property tax for the U. S. Advisory Commission on Intergovernmental Relations contains this still telling statement:

Since each state has had the responsibility for coping with its own property tax problems, the modifications and changes that have been made have followed no uniform national pattern. . . The states have engaged in numerous gradations of erosion of the general property tax; some have classified property within the general property tax structure to permit taxation of several classes at varying relations to value; others have withdrawn certain classes of property from the general base for special ad valorem taxation. No two states are in full agreement as to what the tax base should be, and the four states which have narrowed the base to real property--Delaware, Hawaii, New York and Pennsylvania--differ as to what this class includes.²

The report by the Advisory Commission found it was impossible to determine the magnitude of tax exemption. It noted, however, "As compared with an estimated national wealth of \$1,682.1 billion in 1958 (a figure that does not include intangibles), the aggregate of locally taxable assessed valuation was \$355.7 billion in 1961 (inclusive of intangibles). Because of fractional assessments,

1. U. S. Advisory Commission on Intergovernmental Relations, The Role of the States in Strengthening the Property Tax, Vol. 1 (Washington, D. C.: Government Printing Office, 1963), p. 67.

2. Ibid., p. 30.

the contrast is less extreme than these figures appear to indicate, but still great."

Based on the experience in the states which have property tax exemption statutes as an incentive to acquire pollution treatment equipment, no insurmountable administration problem is posed. The basic authority will be state enabling legislation. A requirement for certification from the state's pollution control agency should be a part of the enabling legislation to insure that the exempted facilities are in fact satisfactorily constructed and operated. Consideration should also be given to providing some voice to the local governments whose tax revenues are affected. In Ohio, for example, the air pollution exemption program allows both the applicant and the county auditor opportunity for a hearing. But on the whole, state laws exempting air pollution control equipment from property taxes have had minimal impact.¹

Excise and Sales Tax Exemptions

Some states provide a range of possible tax exemptions for facilities for air pollution control, from which the company can select the most favorable credit to take in any year. Michigan, New York, and Ohio, for example, exempt air pollution control facilities from most forms of taxation.

Currently available methods of taxation reduction include, as well as rapid depreciation and investment tax credits as discussed

1. Institute of Public Administration, "Industrial Incentives for Water Pollution Abatement," Report to the U.S. Department of Health, Education, and Welfare, Washington, D.C., February, 1965. (Mimeographed.)

above, deductions from annual excise taxes for a percentage of the cost incurred for control facilities. An interesting variation is the State of Florida. In addition to barring collection of sales, use and privilege taxes with respect to air pollution control facilities, Florida also provides that their assessment value for property taxation shall not exceed their values as salvage.

Extent of Subsidy

The importance of these various exemptions is uniformly minimal. The proposal for a personal income tax exemption has a limit of \$50 per year as a deduction--hence few people would get a subsidy of more than \$25 or \$30, if as much. The major effect of the amendment would be to add another complication to an already complicated tax bill.

The advantage to industry of property tax exemptions appears to be small, since the property tax rate, after allowing for deductibility of local property taxes from Federal (and often state) taxable income, is infrequently more than two percent and is usually much less. In some states, notably New York and Pennsylvania, the property tax applies only to real estate (land, buildings, and equipment permanently attached to buildings).

The limited subsidy afforded industry through property tax exemptions can be seen best from a specific example. Assume a firm invests \$100,000 in pollution treatment equipment in a plant located in New York or Pennsylvania. Half of this is in land and buildings and the rest is in machinery not subject to the property tax.

Assume further that the property tax rate is 1-1/2 percent (a reasonably high figure for most jurisdictions). The firm thereby is being relieved, after allowing for Federal and state income tax deductibility, of \$750 a year taxes for a period of, say, 20 years, at a 6 percent discount rate, or about \$8,300. That is, over a 20-year period a firm would recover \$8,300 out of the \$100,000 investment by virtue of property tax exemption. In states where the tax applies to personal property, such as equipment not permanently attached to buildings, the value of the exemption may be somewhat higher.

Since sales and excise taxes are generally of the order of 5 percent, and can be deducted from federally taxable income, the advantage to the firm is usually no more than two to three percent of the cost of the facility--without even considering the costs of operating maintenance and repair.

Cost to Industry

All of these taxes necessitate administrative efforts often far greater than the value to the firm. Consequently, firms often miss advantages that are allowable, simply through the difficulty in keeping track of the available deductions.

In the case of personal tax exemptions, the taxpayer would have to separate the cost of pollution devices from the cost of his car or other purchase in order to claim credit. This might prove burdensome, particularly as he might have to prove the price breakdown was legitimate.

Cost to Government

A major disadvantage of the personal income tax exemption and the various sales and excise tax exemptions is that they impose a fairly large administrative burden on the government compared to the benefit they offer the taxpayer. Considerable difficulty would result in attempting to check each return to insure that pollution control equipment purchased fell within legal limits--and indeed, many forms of pollution abatement not easily allocable to control facilities could fall outside the scope of the legislation.

The case against the property tax exemption is less clear. On the one hand, the exemption is considered to be an expensive device for the municipality. This stems from the fact that property taxes may be deducted as an expense in computing the firm's Federal income tax. Thus, for every dollar that a municipality loses in revenue through providing an exemption, the firm benefits by only 50 cents. For firms in the 50 percent income bracket, the other 50 cents is already saved in deduction from Federal corporate income taxes.¹

1. According to one source "in Ohio, a typical industrial state, the number and monetary value of pollution control exemptions have been increasing substantially each year. In the three years between January, 1966 and the end of 1969, Ohio received 148 exemption applications for purchases listed at \$64.7 million. In the first half of 1970, there were 38 applications for purchases totaling \$31.98 million." The article goes on to note a Business Week (Oct. 4, 1969, p. 118) article claiming much of the pollution control equipment is used to clean water coming into a plant for manufacturing use. It concludes essentially that all expenditure is undertaken only because the firm must comply with health or pollution laws; hence, the exemptions are direct subsidies. Arnold W. Reitze and Glenn Reitze, "Tax Incentives Don't Stop Pollution," American Bar Association Journal, Vol. 57, (February, 1971), p. 127.

One of the greatest objections to authorizing property tax exemption for this purpose is the great erosion which has already taken place through exemptions for other purposes and the consequent harm to the tax base. Other factors are often cited, such as the equities involved in taxing property which does not add directly to the profitability of the firm as well as the already existing erosion of the tax base because of sporadic exemptions.

On the other hand, many economists take a different view, based on long-term considerations. Under this approach, tax exemptions are desirable for structural improvements (as distinct from the land) in order to encourage people to improve their property, for example, by making additions to their homes. This class of improvement would result in a more intensive use of each unit of land, and therefore would cause the value of that land to rise. Consequently, in the long run the municipality would get even more revenue than if the property tax were to apply to improvements as well as land. Thus a prominent economist supports the property tax exemption for air pollution abatement equipment on the grounds that it would make the area a more pleasant place in which to live, and the resulting increase in land values will allow a greater tax revenue than before.¹

1. Mason Gaffney, "Applying Economic Controls," from the Symposium on Air Pollution, Bulletin of the Atomic Scientists, May, 1965, originally titled "Economic Analysis and Air Conservation."

Loans and Loan Guarantees

Government loans serve two purposes: (1) They make funds available at subsidized interest rates, that is, at rates lower than those charged by commercial sources, and (2) They make borrowing easier by providing funds to firms that do not have easy access to banks or other commercial lending sources because their prospects or credit are poor, or for other reasons. Where no direct cash subsidy is provided, that is, where the interest rate and terms are at least as high as bank loans, the only reason for seeking a government loan is that the government is willing to take a greater risk on repayment than commercial lenders.¹ Thus, only marginal firms, or those using marginal or previously untried pollution control methods, are likely to take advantage of such opportunities. The Small Business Administration's loan program--discussed below--demonstrates that there is little interest in this type of loan to finance acquisition of pollution treatment facilities. Moreover, government red tape may deter potential borrowers.

Federal insuring of private loans made to finance treatment facilities has considerable appeal in avoiding several major

1. Banks are notoriously conservative lenders, especially unit banks in small towns. See, for example, Sanford Rose, "Are Those 11,400 Banks Really Necessary?" Fortune, November, 1970, p. 112 ff.

It is quite possible then for the government to loan money to firms which are refused credit by banks and other commercial lenders, and still cover all administrative and bad-debt charges through the interest rate charged. In cases like this, it is unreasonable to consider the loan as subsidized, rather it is beneficial to the nation as a whole in that it reduces market imperfections.

objections to direct Federal loans: public credit is involved only in limited situations; there is no competition with private lending sources; government subsidies are not involved except in cases of default. The guarantee principle has a primary aim: to assure the availability of private credit by minimizing the risks to the lender. With pledge of the resources of the United States Treasury in the event of default by a borrower, interest rates are likely to be lowered so as to provide some savings to the borrower over normal interest rates.

To the borrower, a subsidy is provided if the loan guarantee lowers his interest costs. To the government, costs largely are (a) administrative, and (b) risk insurance. If reasonably tight credit procedures are maintained, the loss premium costs will be minimized. However, from the viewpoint of the borrower, the financial stimulant is low; it will appeal to the marginal firm more than to a firm in a good financial situation.

Federal Role

The Federal Government has encouraged the installation of facilities for pollution control in a variety of programs set up to deal with other national priorities. The Small Business Act, for example, is intended to aid small business to obtain credit, and often managerial training as well, when this aid is difficult to obtain in the private sector. The Act easily is extended to cover other social priorities, such as providing loans and guarantees to small businessmen for air and water pollution control equipment.

Similarly, the Economic Development Administration, whose main aim is to encourage regional development through grants and loans may adopt a subsidiary goal of ensuring that new and expanded plants aided by EDA funds conform to appropriate state and Federal air quality standards.

Small Business Act. Section 7(a) of the Small Business Act allows the Small Business Administration to lend up to 75 percent of the construction cost of facilities for pollution control, as long as the amount does not exceed \$150,000. The interest rate is 5-1/2 percent, and the term 15 years, though generally loans are made for a maximum of 10 years. In addition, the Administration will guarantee bank loans to a maximum of 90 percent of the cost of the facility, or \$350,000, whichever is the smaller. A loan may be guaranteed provided the interest rate is no higher than 2 percent above the prime interest rate. The term is generally 10 years, though a maximum of 15 years may be allowed.

Loans and guarantees are made for the construction of both air and water pollution control equipment, but have not been very popular among small businessmen. According to an SBA spokesman, the Small Business Administration is disappointed that applications and loans are still infrequent, though the question of pollution abatement has generally provoked increasing attention over the past several years. The SBA has computerized its list of loans made over the past several years. An inquiry about loans made for air pollu-

tion abatement revealed that only one application had been accepted. No information was available as to the number of applications.

Economic Development Administration. Loans under this administration are made only to firms locating or expanding in depressed areas. These areas are rated in terms of unemployment, income and migration figures and include about 900 counties, out of a total of 3,072 counties in the country as a whole.

Loans are made for both air and water pollution treatment facilities, but only if the general construction program is expected over time to increase employment or income in the depressed area. The current rate of interest is 6-3/4 percent, and the loan can cover up to 65 percent of the price of the equipment. The total allocation of loans to private industry at present for all forms of construction (most construction would not be for pollution treatment facilities) is \$50,000,000.

Although an EDA spokesman felt the Administration was a forerunner in granting loans for air and water pollution equipment to private industry, he was unable to provide statistics as the EDA does not collect statistics on this basis.

Small Reclamation Projects Act. While this Act does not relate to air pollution, because it involves irrigation it has had an effect on the abatement and control of water pollution as the two areas are so closely related. The Act, passed in 1956, allows

specified organizations,¹ located in the 17 westernmost contiguous States and Hawaii, to obtain loans for small reclamation projects and grants for those portions of the projects which are nonreimbursable as a matter of national policy. The portion of the loan attributable to the irrigation of lands held in 160 acres or less in a single ownership is interest-free. The remainder of the loan is, at present, made as 3-1/2 percent.²

The projects must be primarily for irrigation but may also serve other purposes if these are incidental. They may include domestic, industrial, or municipal water supply and commercial power, flood control, fish and wildlife conservation, and public recreation.

State and Local Roles

Although not available at present, a further possible source of financial assistance for industrial abatement is through state and local government loans, roughly paralleling loan programs suggested for the Federal Government. State and local government loan programs would not be comprehensive nor uniform and cannot be depended upon to support a national policy against air or water

1. The term "organization" shall mean a State or a department, agency, or political subdivision thereof or a conservancy district, irrigation district, water users' association, an agency created by interstate compact, or similar organization which has capacity to contract with the United States under the Federal reclamation laws. The Small Reclamation Projects Act of 1956 (70 Stat. 1044) as amended June 5, 1957 (71 Stat. 48) and September 2, 1966 (80 Stat. 376) Section 2(c).

2. U.S., Department of the Interior, Bureau of Reclamation, Loans under the Small Reclamation Projects Act of 1956 (Washington, D.C.: Government Printing Office, 1969).

pollution, unless the Federal Government itself induces state and local governments to participate by indemnifying them for losses of state or local revenues. Moreover, state constitutional restrictions on use of state or local credit for support of private corporations would limit the number of states and local government which could undertake such a program. Since some states and local governments are already hard pressed financially, they may have stretched available credit--particularly smaller governments--as far as it will go at present.¹ Although it may be only theoretical at present, however, one advantage of state and local loans is the possible availability of lower interest rates due to the tax exempt feature of state and local government bonds, compared to interest rates which the Federal government can charge without subsidization of interest costs.²

Extent of Subsidy

The principal reason for borrowing through Government loan programs is either that the interest rate is lower, or the term longer, than available elsewhere. However, the value to the

1. Since there is enormous variance in the tax-and-borrowing capacity of state and local governments, generalizations are necessarily difficult to make and subject to numerous qualifications.

2. New York City has experimented with a low-cost loan program to assist landlords in rehabilitating rundown multiple dwellings. The program has had little success, largely due to the red tape of obtaining loans and particularly where the potential borrower sees no immediate advantage to himself. The lack of response by polluting firms to the Small Business Administration's loan program appears to be due to the same causes.

company is not usually a large proportion of the cost of the facility. For discussion purposes, the following assumptions may indicate the value of the loan plan: one, the loan is at 5-1/2 percent and is paid back in equal installments over a 10-year period. This could be the case for a loan under the Small Business Act; and two, corporate income tax rates are 25 percent and 50 percent.

Table 6-2 indicates the value of a Small Business Act loan to firms with representative costs of capital and tax rates. The table illustrates that the advantage to the firm increases with the difference between the firm's cost of capital and the interest rate at which the government lends. But even with a 10 percent spread, on a 10-year loan, the effective subsidy is only 15 percent for a large firm (50 percent tax rate), and less than 25 percent for a low profit firm.

Another table could be prepared to show that lengthening the payback period would increase the effective subsidy of low-cost loans but long-term programs (say 50 years) are unlikely to be enacted.

Cost to Industry

As in the case of the accelerated depreciation and tax credits discussed above, loans and loan guarantees entail inevitable administrative burdens, operating costs and risk involved with the installation of new control equipment. These difficulties have made loans and loan guarantees relatively unpopular with private industry, at least if one can judge from the paucity of industry response noted above.

TABLE 6-2

PRESENT VALUE OF SBA LOAN

Value per \$1000 (5½%, 10 years)	Cost of Capital		
	5%	10%	15%
Yearly Payments ^a	\$130	\$154	\$191
SBA Yearly Payments	<u>133</u>	<u>133</u>	<u>133</u>
Difference ^b	-3	21	58
Present Value ^c	-23	136	304
25% Tax Rate ^d	-17	102	228
50% Tax Rate ^d	-12	68	152

a) For each \$1000 borrowed, the assumption is made that 10 equal yearly payments must be made under the assumption that the firm's cost of capital is 5%, 10% and 15% respectively.

b) The difference represents the yearly benefit (reduced interest payments) which occur to the firm. A firm with a cost of capital of 5% will, of course, suffer a loss if it borrows at 5½%.

c) Present value of the 10 yearly differences, calculated at the firm's cost of capital.

d) The difference in interest payments will be reflected in identical changes in taxable income for the firm. If the Federal and state marginal income tax rate is 25%, one quarter the advantage will be lost to the tax collector. If the rate is 50%, half will be lost.

Cost to Government

A disadvantage inherent in any loan program is that the lending agency must exercise responsibility during the term of the loan. Tax concessions, such as accelerated depreciation, tend to be self-executing and do not entail continuous administration.

However, if the costs of the loan program--including the cost of government borrowing, administration and default costs--are covered by the interest rate charged to firms, then the program is cost-free to government and to the taxpayer--or society. Consequently, loan programs can well be justified as a supplement to other programs even though they are unsuccessful standing alone as inducements to control air pollution.

Grants

No Federal agency presently offers grants for the purpose of air or water pollution control to private industry, although grants are used to induce municipalities to build facilities for pollution abatement.¹ The 1966 Report of the Governors summarizes aid given to local governments for waste treatment but concludes that similar programs have not been made available for industry.

Numerous industrial concerns have indirectly participated in the benefits of the Federal grant program for municipal sewage treatment facilities by discharging their wastes into the municipal sewage

1. Grants are provided to municipalities by the Federal Water Quality Administration, the Department of Housing and Urban Development, the Economic Development Administration, and the Farmers Home Administration. The following section discusses these programs in more detail.

system. However, although industry utilizes about two-thirds of the water used in our Nation, neither the states nor the Federal Government have provided a program of grants to those industries which discharge their wastes directly into rivers and other bodies of water, i.e., not into a municipal sewage system. Instead, the prime approaches to the problem of industry's direct waste discharges have been to get industry to construct waste water treatment facilities (a) voluntarily or (b) under compulsion, either through court action or the threat of court action, by state agencies or the Federal enforcement procedures which are initiated by conference under the Federal Water Pollution Control Act.¹

In other areas, however, grants to individuals or, less frequently, to corporations have been made to meet pressing national, state, or local needs. Welfare payments, scholarships, and agricultural subsidies are all examples of payments made to reach specific national goals.

Federal Aid to State and Local Governments

The Federal Government often uses loans or grants to aid state and local governments in carrying out projects Government feels are socially beneficial. The Federal intent is usually to help communities stretch their limited financial resources to provide needed public services. In addition, many Federal programs can be justified by their "spillover" effects. An example is a Federally-assisted sewage treatment plant of one municipality that provides benefits to other communities downstream. Consequently, Federal Government

1. U.S., Congress, House, Committee on Government Operations, Views of the Governors on Tax Incentives and Effluent Charges, H. Rept. 1330, 89th Cong., 2d sess., 1966.

participation helps to internalize the costs of sewage treatment by providing payments to polluters to reduce their effluent to help those downstream.

In air pollution, however, there is much less scope for municipal action in a sense similar to the provision of central water treatment facilities. The major Federal thrust has been Federal funding of state and local air quality control regions; and grants for air pollution abatement have not been included. Even in solid waste, where a case might be made for central incinerators, with greater possibility of smoke control, the Federal Government has funded only planning efforts, and research and development programs.

Federal Air Quality Act.¹ There are two grant programs for which funds are allocated to assist states and localities in carrying out surveillance and control programs in air pollution.² The planning grant program for interstate air quality commissions (Section 106) depends on the establishment of air quality criteria and designation of air quality control regions. The second program involves grants for control programs (Section 105). Over 200 agencies receive grants under one or more of the four categories: (1) planning and development, (2) establishment, (3) improvement, and (4) maintenance. A third authorized program is for survey and demonstration support. However, funds have not been allocated.

1. Refer to Chapters 1 and 3 for a consideration of the role and effectiveness of these grant programs in aiding the Federal air pollution control objectives.

2. H. G. Berlin, "Federal Aid for Air and Solid Wastes Programs," Environment Reporter, Monograph No. 5, Vol. 1, No. 23 (1970).

Federal Water Pollution Control Act. The Water Pollution Control Act of 1956 authorizes the Federal Government to make grants to municipalities to help finance the construction of sewage treatment works. The act was amended in 1961, 1965 and 1966 to increase the funds authorized. Grants can also be made to reimburse states or local communities for projects constructed after June 30, 1966, which proceeded without Federal assistance or with reduced Federal aid because of the lack of Federal funds. The extent of the reimbursement is limited to the amount that would have been provided if adequate Federal funds had been available.

Applicants may include facilities to serve Federal installations in the total project, and the cost of such facilities will be eligible for Federal grant participation provided no financial contribution toward construction of project facilities is made by the concerned Federal agencies.

Grants are limited to 30 percent of the eligible cost except that a grant may be increased to 40 percent in states which agree to pay not less than 30 percent of the estimated reasonable cost of all projects for which Federal grants are to be made from the states' allocations. The Federal grant may be increased to 50 percent if a state agrees to pay not less than 25 percent of all projects and enforceable water quality standards have been established for the waters into which the project discharges. A grant may be increased by 10 percent, to 33, 44, or 55 percent, as appropriate, if the project is certified by an appropriate metropolitan or

regional planning agency as conforming with a comprehensive metropolitan area plan.

Additional impetus for the program came through Governor Rockefeller's proposal:

. . .and the approval by the New York State voters in 1965 of \$1 billion "Clean Waters" bond issue. The size of the bond issue was impressive enough, but it was the method of financing that proved most influential. The Rockefeller plan in essence put New York in the position of prefinancing the Federal Government's contributions to waste treatment construction within the state. The state agreed to make funds available to the localities as if the Federal Government had paid its full share; the state would then attempt to recover the amount of the Federal share when Congress appropriated sufficient funds.

The Rockefeller plan was designed to meet two problems--the lag in Federal appropriations and the rapidly rising costs of waste treatment construction. It permitted the localities within a state to proceed immediately with construction rather than waiting until Federal funds were available. The New York State approach is being considered by several other states, and it received indirect sanction in the 1966 Federal act which authorized states to collect retroactively on construction grants.¹

The Federal Water Pollution Control Act authorized appropriations of \$450 million for 1968, \$700 million for 1969, \$1 billion for 1970 and \$1.25 billion for 1971. Of these amounts, or whatever portion of them may be appropriated by Congress for any fiscal year, \$100 million is allotted each fiscal year among the states on the basis of their population and per capita income in relation to the national population and per capita income. That part of an

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 124.

appropriation in excess of \$100 million is allotted to states on a straight population basis.

Department of Housing and Urban Development.¹ The U. S.

Department of Housing and Urban Development administers a Basic Water and Sewer Facilities Grant Program which:

. . . helps communities stretch their limited financial resources to provide needed public services for their citizens. But water and sewer system development can contribute much more than basic service facilities. Communities that initiate wisely planned projects are responding effectively to social needs as well. Such projects frequently trigger local employment opportunities, promote an increased housing supply, and provide an atmosphere conducive to economic growth.

Local public bodies and agencies may apply to HUD for grants to finance up to 50 percent of the cost of building new water or sewer systems or of enlarging, improving, or rehabilitating present facilities. HUD will supplement the grant to cover relocation payments to individuals, families, and businesses displaced from land acquired for a project.

To qualify for a grant, the applicant must be a city, town, county, Indian tribe or a public agency of one or more States or cities. The applicant must have adequate legal authority to plan, finance, build, and operate the proposed project.

To qualify for assistance, a proposed water or sewer facility must be necessary to improve health or living standards and to promote community development.

Another important measure of the project's value is the effect it will have upon crucial community problems. Typical problems might include housing, low- and moderate-income families, or abolishing patterns of housing discrimination.²

1. The Housing and Urban Affairs Act of 1965. P.L. 89-117.

2. U.S., Department of Housing and Urban Development, Basic Water and Sewer Facilities Grants (Washington, D.C.: Government Printing Office, 1970).

Other restrictions include fair treatment of landowners who are expropriated, wage rates which are not less than the prevailing wage, and the construction contract is also subject to the Contract Work Hours Standards Act and to applicable regulations of the U. S. Department of Labor.

Assistance from Other Agencies. Other Federal legislation pertaining to Federal grants for waste treatment facilities and related projects are: one, the Appalachian Regional Development Act of 1965 (Public Law 89-4) which permits the U. S. Department of Commerce to increase contributions from other Federal programs in Appalachia up to 80 percent of project costs; two, the Public Works and Economic Development Act of 1965 (Public Law 89-136) which authorizes the U. S. Department of Commerce to make grants and loans for water, sewer and other public works facilities in economically distressed areas (up to 80 percent for areas unable to supply the required share); and three, 1965 Amendments to the Consolidated Farmers Home Administration Act of 1961 (Public Law 89-240) which authorizes the U. S. Department of Agriculture to make grants and loans to rural communities of 5,500 population or less for construction of rural water and waste disposal systems.

Solid Waste Disposal Act.¹ The Act provides for protection of public health through grants-in-aid for research and demonstrations, offers funds for comprehensive planning by state or inter-

1. P.L. 89-272. The Solid Waste Disposal Act of 1965 was amended by the Resource Recovery Act of 1970. (P.L. 91-512).

state agencies so that solid waste disposal management might be handled on a regional basis and provides grants and technical assistance to local and state authorities to increase their management capabilities.¹

Section 204 covers studies, investigations and demonstrations to be carried out by public or nonprofit private organizations, while section 206 provides assistance for surveys and planning to state or interstate bodies engaged in solid waste disposal activities. The Resource Recovery Act of 1970 extends the Solid Waste Disposal Act of 1965 and shifts the emphasis from conventional disposal to the recycling and recovery of materials and energy from solid waste.² Support for proposals for resource recovery systems demonstration grants and programs for the removal of abandoned automobile hulks was increased; the Act provides for Federal grants of a two-thirds share of planning costs for municipalities and three-quarters costs for other bodies. Similarly, there are provisions for training grants for personnel in the design, operation, and maintenance of solid waste disposal and resource recovery facilities.

Summary and Conclusions

The subsidy programs discussed include accelerated depreciation, investment tax credits, tax exemptions, government loans and loan guarantees, various forms of tax exemptions and direct aid

1. H. G. Berlin, "Federal Aid for Air and Solid Waste Programs," Environment Reporter, Monograph No. 5, Vol. 1, No. 23 (1970).

2. Ann Tasseff, "Solid Wastes Programs and Research," Environment Reporter, Monograph No. 6, Vol. 1, No. 33 (1970), p. 21.

in the form of grants and technical assistance. The defining characteristic of these programs is that only part of the cost of pollution control is borne by the government. The rest must be borne by industry itself. In this section, cost sharing measures are reviewed and summarized with respect to extent of subsidy, cost to industry, cost to government, inherent bias, difficulty of administration and the possible desirability of these programs.

Extent of Subsidy

One way to evaluate each of the cost sharing measures is in terms of the extent of subsidy given to industry. This evaluation, however, depends not only upon the provisions of each particular measure but upon industry-borrowing rates and general tax rates as well. Thus, no precise measure of the extent of each subsidy exists. However, the accompanying Table 6-3, from an authoritative government study, illustrates representative values of various proposals. It will be noted that even under the most favorable conditions--a 20 percent tax credit combined with a one-year accelerated depreciation--the extent of subsidy to the firm amounts to no more than one-third of the capital costs of the control equipment. Another government study surveying state attitudes and industry responses to tax incentives concluded:

Available information indicates that the state tax incentives have up to now been a minor factor in encouraging industry to accelerate water pollution abatement. In the states where cost data is available, the amount of state funds involved is, with perhaps one exception, very small. In other states, the tax relief program was adopted too recently to

Table 6-3

COMPARISON OF THE ADDITIONAL SUBSIDY TO INDUSTRY THROUGH ALTERNATIVE FORMS OF FEDERAL ASSISTANCE^{a/}

Type of Assistance	Subsidy as a Per Cent of Capital Cost	Subsidy as a Per Cent of Annual Cost ^{c/}		Rough Estimate of Likely Assistance to Industry for Capital Expenditures to Meet Hypothetical Stan- dards in 5 Years: 1969-1973 ^{d/} (In Millions)	
		Water	Air	Water ^{e/}	Air ^{f/}
Accelerated amortization: 5 years	13%	5%	2%	\$241	\$ 61
3 years	17	6	3	315	80
1 year	21	9	4	389	99
Tax credits: 14%	18	7	4	333	85
20%	25	10	5	463	118
Accelerated amortization and tax credit combined:					
14% tax credit and 3-year accelerated amortization	35	14	7	648	165
20% tax credit and 1-year accelerated amortization	46	21	10	851	216
Reduced interest loans: ^{b/}					
6% (3% below discount rate)	11	4	2	204	52
4% (5% below discount rate)	17	7	3	315	80

a/ Assume 52.8 percent effective tax rate, 15-year functional life (straight life) for pollution abatement facilities and 10 percent discount rate. Excluding accelerated depreciation now available in existing tax laws--e.g., sum of digits or double declining balance.

b/ 15 years, straight reduction loan, 9 percent discount rate for industry (if assume 6 percent, then zero gain for 6 percent interest loan and 7 percent or \$71 million gain for 4 percent interest loan).

c/ Includes annual capital cost (amortized) and operation and maintenance expenditures, increase in total cost of abatement because of excessive use of artificially cheaper capital costs.

d/ Assuming all capital expenditures are subsidized whether to industry or households. Capital costs would undoubtedly drop after the initial investments are made to achieve standards.

e/ Based on industrial profiles: \$1.15 billion additional investment plus \$.7 billion replacement investment which equals \$1.85 billion for BOD and suspended solids for hypothetical standard of 85 percent treatment of industrial wastes.

f/ Assuming 20 years of additional capital investment is made in 5 years. The total capital as indicated by the "Typical City" Study should be \$470 million to achieve a hypothetical standard of reducing human exposure by 60-75 percent of SO_x and particulates.

Source: Douglas B. Wilson, "Tax Assistance and Environmental Air Pollution," Tax Policy, Vol. 37, Nos. 7-8, (1970), p. 5.

allow the Governors to comment on its value, or the methods of local administration did not provide for centralized computation of data.¹

The intent of this report has been to assess various possible governmental policies that might help reduce pollution so that communities might meet desired ambient air quality standards. To the extent that cost sharing arrangements are proposed as an incentive to pollution abatement, it must be asked why industry should accept this approach to pollution abatement. One can accept as a general truth that businessmen attempt to maximize profits. Thus, if private industry is to receive only partial compensation from the government, it will do nothing to abate pollution unless further inducements tip the scale to profitability. Among these inducements might be the reduction in damages of air pollution to their own facilities, process changes that increase production (and hence revenues) at the same time they reduce air pollution, and further tax benefits from other levels of government.²

By themselves, cost sharing arrangements fall far short of making air pollution control a profitable investment for private industry. In theory, property tax exemption of pollution abatement

1. U.S., Congress, House, Committee on Government Operations, Views of the Governors on Tax Incentives and Effluent Charges, H. Rept. 1330, 89th Cong., 2d sess., 1966.

2. The possibility has been advanced that subsidies could be combined with legal restrictions, including fines and jail sentences, to provide a palatable package to induce businessmen to make decisions about air pollution more nearly corresponding to social, rather than private costs. The avoidance of fines and jail sentences has a perhaps measurable monetary value to a businessman, so that by adding the reduction in costs (fewer penalties) to subsidies gained through abating pollution he may determine whether or not to limit pollution.

equipment has much to recommend it. But in practice, its monetary advantage is so small that it cannot be given priority as an inducement to reduce pollution. Government loans and loan guarantees offer certain theoretical advantages--overcoming the misallocation of resources caused by risk aversion of private banks--but have similar disadvantages in practice. Tax reductions--accelerated amortization, investment tax credits, and exemption from sales taxes--all offer some degree of subsidy for the installation of air pollution control equipment. But, again, and especially at the state level, the subsidy is too small to be effective.¹

The Role of Public Relations. In competitive industries, firms do not earn enough to be able to engage in the "luxury" of pollution control greater than that forced upon them by law. Similarly, there are no incentives for monopolies to spend noticeable proportions of their profits on air pollution abatement merely to enhance the wellbeing of those around them. However, in situations where there are few firms in the industry, it may be possible for one firm to advertise its role in pollution abatement and thereby increase its market at the expense of the others.² Other firms may retaliate; public relations in the form of announcements about pollution control may be a form of non-price competition.

1. It should be re-emphasized that these comments apply to the impact of cost sharing arrangements in the absence of regulation which would make all firms abate pollution. As discussed in the Introduction, each government approach has been considered on its own merits rather than a supplement to one of the other approaches. See also "Cost Sharing As An Encouragement to Compliance" below.

2. From another perspective, air pollution control agencies can use the threat of adverse publicity as an effective technique to induce some firms--and even some industries--to control pollution. See Chapter 2, the case study of voluntary compliance in the airline industry.

As a result, all firms can raise their prices and lose few customers in the process. If revenues created through such price increases or market share increases do not cover the full cost of pollution abatement, there is no decisive incentive to abate. However, the combination of increased revenues and cost sharing measures may together be sufficient to create a profitable result from pollution abatement.

As pollution has become a major issue, some firms have taken considerable pains to inform the public of their efforts to clean up. The steel industry, for example, is generally considered oligopolistic, but firms obviously have few opportunities to supply a product noticeably different from others. Consequently, public service advertisements stress such factors as social responsibility, including now the firm's role in pollution abatement. The pulp and paper industry is another such example. Again, this industry has been cited often as a major polluter and is recognized as such by the public. Advertising efforts to abate pollution, then, may persuade customers to switch orders to an advertiser. Potlatch Forests, Inc., for example, used a national advertising campaign to inform the public "it cost us a bundle but the Clearwater River still runs clear". The advertisement continues

Conflict between man's devotion to nature and his own effect on his environment has existed since time began. Potlatch people, more than most, have demonstrated total commitment to pollution control. On the Clearwater River in Idaho we have spent over 3½ million dollars to assure clear water. Our latest effort is a \$1½ million primary clarification plant that removes 16 to 18 tons of wood fiber, bark and clay from 28 million gallons of

water each day. Additional millions of dollars are already committed to keep the Clearwater clear even when future dams create slack water for barge travel from the Pacific to Lewiston. The same continuing effort goes on at all our operations against all pollution. Our commitment is clear.¹

1. A number of observers are less sanguine about Potlatch's efforts. The Council on Economic Priorities recently released a 479-page report on the pulp and paper industry's pollution abatement efforts; Potlatch was one of the firms receiving most criticism for lack of effort in pollution abatement. (Cited in Alexander Ross, "Are There Profits in Social Responsibility?" Financial Post, March, 1971.) Newsweek was even more blunt ("Pollution: Puffery or Progress?" December 28, 1970, p. 49):

But what Potlatch. . . neglected to mention. . . was that the picture had been snapped some 50 miles upstream from the company's pulp and paper plant at Lewiston, Idaho. What is more, Potlatch pumps its fresh water from the Clearwater-- but dumps up to 40 tons of suspended organic wastes back into the Clearwater and the nearby Snake River every day.

Aside from the filth that spews into the river, Potlatch concedes some 2.5 million tons of sulphur gases and 1.8 million pounds of particulates billowed from the plant stacks last year; in fact, the Lewiston plant enjoys the dubious distinction of being the only industrial mill in the U. S. to have been the subject of separate air- and water-pollution abatement hearings before Federal authorities. Each day, on leaving the plant's parking lot, employees sluice down their autos with a company-installed car wash to protect the cars' paint from the corrosive sodium sulphate that sifts from the air. When an enterprising local college newspaper editor pointed out the discrepancy between ad copy and reality, the company responded by cancelling all corporate advertising. As Potlatch president Benton R. Cancell explained it: "We tried our best. You just can't say anything right anymore--so to hell with it."

. . . under pressure from Federal agencies, Potlatch itself has announced plans to spend \$9.6 million on pollution-abatement equipment for the Lewiston plant.

The Newsweek article goes on to point out the numerous discrepancies between advertising and fact, commenting that the Federal Trade Commission is investigating the area.

While competitive firms cannot obtain more than partial reimbursement for air pollution control, this is not necessarily true for oligopolistic firms. The purpose of advertising such as the Potlatch advertisement is to persuade potential customers that the company is a solid, dependable company. When these customers switch to the advertiser, the increased market share provides additional profits that more than make up for the expenditures on air pollution control.¹

Many critics of industrial attempts at air pollution abatement are well aware that oligopolistic firms are their best targets. John C. Esposito, for example, concentrates on well known firms such as General Motors, Union Carbide, and Commonwealth Edison of Chicago in his book Vanishing Air. The intention is to provide a very negative public image for those firms which rely extensively on advertising and public relations. These latter types of firms are most susceptible to the attack Esposito mounts.²

1. One economist suggests that revenues may be increased sufficiently through increased prices and increased market shares that firms in some industries would show a profit from pollution abatement even if cost sharing measures were not available. This, of course, depends upon consumers really desiring pollution control enough to pay marginally more for products which offer this feature. It is pointed out that, if consumers are not willing to pay even marginally more, their commitment to pollution control might well be re-examined by politicians anxious to force firms to abate. William P. Gramm, "A Theoretical Note on the Capacity of the Market System to Abate Pollution," Land Economics, Vol. 45, No. 3 (1969), pp. 365-368.

2. John C. Esposito, Vanishing Air (New York: Grossman Publishers, 1970).

Corporations are well aware of the tactics of their critics, and have retaliated vigorously. In 1965, General Motors found it necessary to apologize on national television when Ralph Nader was able to prove they had hired a detective to shadow him in an effort to discredit him and his recent book "Unsafe at Any Speed." Opposition to critics of industry has become more civilized. Mr. Roche, chairman of General Motors, recently delivered a tough speech, accusing critics of U. S. corporations of threatening the free enterprise system, assaulting America's reputation and creating an unfairly negative image of U. S. business.¹

Other Inducements. Cost sharing measures may possibly be sufficient inducements to oligopolistic industries because they tip the scales for air pollution abatement from a loss to a profit. Cost sharing is probably most effective as a supplement to revenue gained from the recovery of valuable by-products. While this is not likely to happen often, it remains the most likely possibility. The second, and much more limited, possibility is that a company manager may feel that pollution abatement will increase his personal stature among his peers; he may use subsidies as an excuse to reduce pollution even though the decision is actually costly to the shareholders.

It is possible that varying combinations of these factors--beneficial publicity, valuable by-products, and managerial interest--exist, cost sharing measures may tip the balance toward air pollution

1. "GM's Roche Says Attacks on Big Business Undermine Free Enterprise, Slander U. S.," Wall Street Journal, March 26, 1971, p. 4.

abatement. However, the likelihood that cost sharing would be decisive is probably limited, and certainly it would be impossible to assess the impact of such a strategy.

Cost to Industry

Because cost sharing measures by their nature cover only part of the costs of air pollution abatement, industry must pay the rest. Indeed since government subsidies generally cover only capital costs, business must pay the entire cost of operating, maintenance and repair.

Another source of increased costs to industry is the inherent bias in subsidizing only capital costs. In addition, each of the cost sharing approaches would entail heavy administrative costs as the industry attempted to justify its claim to the appropriate government agency. Both of these considerations are discussed in more detail in the following sections.

Inherent Bias. The most important source of higher costs associated with subsidies concerns their inherent biases.¹ Among the biases inherent in these forms of aid to industry are the following:²

1. Paul H. Gerhardt, "Incentives to Air Pollution Control," Law and Contemporary Problems, Vol. 33, No. 2 (1968), pp. 361-64, contains a discussion of a number of these biases in detail.

2. One article points out that, even if pollution control equipment were installed, management might very well be tempted not to operate it whenever possible. It could sit idle on nights and weekends, or even close down entirely between inspections. Arnold W. Reitze and Glenn Reitze, "Tax Incentives Don't Stop Pollution," American Bar Association Journal, Vol. 57 (February, 1971).

1. Against methods requiring high operating and maintenance costs--tax and loan legislation normally cover the capital costs of air pollution abatement facilities, but exclude operating and maintenance costs from special consideration;
2. Against changes in processes to those with lower pollution content--since these changes can rarely be separated from process changes to increase productivity, costs may rarely be included;
3. Against changes which would result in recovery of valuable by-products; and
4. Against changes in factors--such as a change to low sulfur fuel to avoid sulfur dioxide emissions.

Each of these biases occurs because only capital costs are subsidized. There generally are several options for abatement, ranging from fuel substitution to process changes to equipment for air pollution control such as precipitators. Each has a different proportion of capital costs to total costs, with the result that the relative costs of abatement are distorted. For example, the cost sharing approaches would offer virtually no subsidy for fuel substitution, but cover a significant proportion of the costs of precipitators.

The subsidy will not change the decision of the businessman if the heavily subsidized abatement methods are already the least expensive form of abatement, or if they are, even with the subsidy, far more expensive than unsubsidized abatement methods. The instances

1. Capital costs are estimated to account for only about one-eighth the total cost for air pollution abatement. Fuel substitution, for example, is the least costly alternative in over half the cases involving sulfur oxide air pollution abatement. Douglas B. Wilson, "Tax Assistance and Environmental Air Pollution," Tax Policy, Vol. 37, Nos. 7-8 (1970), p. 6.

when the cost sharing arrangement sufficiently distorts relative costs to the businessman to cause him to use a highly subsidized method of abatement rather than another method represent a wasteful misallocation of resources. This waste is equal to the real difference in costs between the two methods.

The subsidy is split two ways. Part goes to cover the wasteful misallocation of resources, while the rest goes to the businessman as a reward for using an inefficient method. The government, of course, loses a large subsidy on an expensive method of abatement rather than a small subsidy on a less expensive form of air pollution control.

There is another kind of bias. This occurs in choosing which firms abate. Cost sharing arrangements leave this decision up to the individual businessmen; but some are more able to benefit from the provisions than others. First, the advantages of capital intensive equipment are likely to exist only for the largest firms. This means that the smaller firms will have a disadvantage in competing for government funds, and likely will then have to abate at a very high cost relative to larger firms. Similarly, firms with low profitability will be little induced by the prospects of greater tax exemptions, and will be unlikely to receive very favorable consideration for loans.

Administrative Costs. Each cost sharing measure would entail administrative costs for industry; the major ones are: first, in persuading the Internal Revenue Service that the proposed equipment should be considered pollution abatement equipment and that it does not aid the firm's profitability; second, in revising accounting procedures to take advantage of the subsidy. Of all the cost sharing measures, the investment tax credit has the least disadvantage in this respect.¹ Finally, further costs to industry may result from disruptions of production to install control equipment and the risks associated with new or emerging control technologies. In many cases, the fact that cost sharing arrangements are inefficient and lead to administrative problems as well rules them out of consideration by smaller firms.

Cost to Government

In 1967, Federal Government expenditure on air and water pollution abatement was estimated at \$500 million, and this amount has been growing rapidly each year. Most of these funds are spent at the municipal level, though two non-municipal devices--the tax credit and accelerated depreciation--were estimated to cost about \$50 million. This is a small proportion of the \$2/3 billion estimated

1. According to one source, the application form for investment tax credits was cleared in only ten weeks by the Bureau of the Budget and its Advisory Council on Federal Reports, which was set up to act as a liaison between business and the Bureau. In contrast, the National Air Pollution Control Administration (now Air Pollution Control Office) was unable to clear a questionnaire on plant emissions for eleven months. John C. Esposito, Vanishing Air (New York: Grossman Publishers, 1970), p. 78.

that industry itself spends for water pollution abatement alone. It should be noted, however, that this estimate ignores the implicit subsidy of the Federal corporate income tax provisions since about half the above \$2/3 billion is recovered through tax rebates.¹

While the total cost to government would vary according to the proposal, as well as to other factors, an indication of the magnitude can be gained from Table 6-3 (p. 6-43). The final column shows air pollution costs to the Federal Government of \$33 million to \$155 million over five years.

Evaluation of the cost to government of subsidies is difficult because comparative data are lacking for other approaches. It is generally acknowledged, however, that relative to other approaches, the costs of subsidies are high. Thus, an authoritative government report recommended against further use of subsidies, among other things, because of their tendency to "cause the total cost of pollution abatement to rise significantly. . ."² To the extent that total costs are greater, the same can be said for costs to government through cost sharing arrangements for air pollution control.

1. The Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised), "Cost Sharing with Industry?" Washington, D.C., 1967, p. 26. (Mimeographed.)

2. Ibid., p. 5.

Inherent Bias. Several types of bias have been outlined in a previous section. Their effect is to guide businessmen away from the most effective means of abatement to those means for which subsidies are offered. While they gain only part of the subsidy, government loses the entire amount. In effect, a noticeable proportion of the money allocated by government is wasted because it is spent on relatively expensive means of control.

There is a second type of bias. This occurs in choosing which firms abate. The cost sharing approaches based on tax exemptions are particularly prone to bias in this regard. This is because a firm with low profits will gain very little from tax exemptions, particularly since there is a low marginal rate for corporate taxes. On the other hand, loans and grants must be allocated among different applicants by the agency. It is difficult, if not impossible, to be able to determine in advance which firms should get subsidies without upsetting any mechanism set up to ensure an efficient allocation of resources.¹

Equity. The various tax reductions are beneficial only to those firms making sufficient profits to need an exemption. As has been outlined in previous sections, only large firms making

substantial profits because of their near-monopoly positions are likely to be tempted very much by cost sharing measures. But government subsidies must be made up out of general revenues, the bulk of which come from moderate income groups and smaller firms. In fact, although legislation of this type is frequently advocated on behalf of small businesses, it is quite possible their general tax liability will increase as much as, or more than, the gain they might make from such subsidies. The only clear winners would appear to be wealthy firms who are probably in least need of aid.

Consumer Accountability. When industry is required to pay for air pollution control, it may generally be expected that the costs will be passed along to consumers in the form of price increases. (Occasionally, shareholders and suppliers will pay a portion of the bill if the industry is sufficiently monopolistic.) These price increases result in fewer purchases of goods associated with heavy pollution; this in itself reduces production, and hence pollution, by the offending firm.

If subsidies are used, the consumer and producer are no longer rewarded for shifting to products which are more socially acceptable (i.e., produce less pollution). Because this automatic market effect is lost, government is left with a more difficult problem in reducing pollution.

Public Accountability. One difficulty with cost sharing measures such as accelerated depreciation or investment tax credits is that they cannot readily be targeted to meet priority areas.

Such legislation is typically national in scope, allowing polluters from low-priority areas the same benefits as those in high-priority areas. Douglas B. Wilson points out that transportation is a major source of air pollution, yet it would be difficult to single out transportation for special reductions.¹ At the same time, requirements for pollution control and relevant measures tend to change from year to year. But tax regulations are not readily adaptable to these changing requirements. Once a provision is put into the law, it is entrenched and difficult to remove.²

Failure of Communication. An additional problem with cost sharing measures when the proportion paid by government is very low (as it is in most of the programs discussed above) is that industry will often be unaware of the opportunities available. This is particularly true of state programs, as indicated earlier in this chapter. Low interest loan funds set up for financing equipment for

1. Douglas B. Wilson, "Tax Assistance and Environmental Air Pollution," Tax Policy, Vol. 37, Nos. 7-8 (1970), p. 7.

2. The Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised), "Cost Sharing With Industry?" Washington, D.C., p. 27. (Mimeographed.) emphasizes this point:

Moreover, public accountability of such subsidies is difficult and would probably create an annoying problem in its removal once social policy dictates a change.

air pollution abatement (and other similar environmental improvements) seem to be particularly neglected.¹

Difficulty of Administration. A final problem associated with most cost sharing arrangements is their difficulty of administration:

. . . it may be difficult from a practical administrative standpoint to determine how much of a plant's investment should be charged to pollution control and how much to process changes undertaken primarily for increased productivity that incidentally may effect a significant reduction in the production of air pollution.²

Hence, to the extent that pollution control entails more than purchase and installation of a specific piece of equipment with low operating and maintenance costs, it is comparatively difficult from an administrative point of view to assign costs. A further complication arises when air pollution control produces valuable

1. Many examples of this phenomenon have been observed. For example, The Environment Reporter, after conducting a survey noted that:

One of the most active individuals interviewed. . . was unaware that a number of banks throughout the country have available low-interest loan funds earmarked for use in anti-pollution programs, . . . and that, in large measure, the money is going begging. For example, Winters National Bank and Trust Company, Dayton, Ohio, has disbursed \$100,000 and committed another \$900,000 for pollution control loans, at rates below the current six percent prime interest rate, but still has another \$1 million available.

The Bureau of National Affairs, Inc., "Current Developments," Environment Reporter, Vol. 1, No. 40 (1971), p. 1044.

2. Paul H. Gerhardt, "Incentives to Air Pollution Control," Law and Contemporary Problems, Vol. 33, No. 2 (1968), pp. 361-62.

by-products. A recent publication of private industry cites concrete examples of this problem:

A steel company has developed a smoke-cleaning process which traps most of the iron dust particles and, after putting them through a sintering process, recharges them for use in its open hearths.

A chemical company has a plant with a dust collection system that accumulates about 4,000 tons of fly ash a year. This "waste" material contains about 70% carbon, and its re-use as fuel brings the company substantial savings. Another plant of this same company used to emit foul smelling benzothiazole. Control equipment costing \$85,000 was installed and now the company recovers about \$50,000 worth of benzothiazole a year.

A chlorine user with air pollution controls is now recovering "waste" chlorine that had formerly cost him \$60 a liquid ton. The recovery costs are now down to only \$19 a ton.¹

In conclusion, the practical problems of administering cost sharing measures for air pollution control may be considerable, particularly where control techniques are complicated and the assignment of costs is heavily dependent upon engineering and economic judgments.

Desirability of Cost Sharing Measures

The desirability of cost sharing measures can be measured in terms of their meeting a variety of possible objectives. Although the objectives of these programs are seldom clear from their enabling acts or legislative proposals, three possible objectives of cost

1. "The Case for Clean Air--A Special Report," Mill and Factory (April, 1967), pp. 41-56, cited in Paul H. Gerhardt, "Incentives to Air Pollution Control, Law and Contemporary Problems, Vol. 33, No. 2 (1968), p. 362.

sharing policies are conceivable: first, as inducements to firms to install air pollution control equipment; second, to fulfill a recognized obligation on the part of government to share in the cost of achieving clean air; and third, to ease any undue burden that pollution control requirements might place on industry.

An incisive summation of cost sharing arrangements, as measured against these three objectives, has been advanced as follows:

1. Inducement to Firms for Air Pollution Control

[Cost sharing measures], e.g., the 7% investment credit normally make capital investments more profitable for a firm. For example, a typical firm may have an administrative policy of investing in capital equipment that will give them a 20% return on their investment. If an investment credit were added, it would increase the return on some investments that were previously below the 20% cutoff level to a point above the level and the firm would therefore increase its total investment.

Air pollution investments are not, however, revenue producing. (Equipment that results in a net revenue would be installed for process reasons and not air pollution control reasons.) In order for a tax credit to act as an incentive for air pollution control, it must, therefore, cover 100% of the net cost of installing and operating the equipment plus an amount equal to the required return on investment. Only this amount of assistance would make an investment in air pollution equipment as attractive to the firm as other investment opportunities. This statement is backed up by the National Air Pollution Control Administration's experience during the period from October 10, 1966, to March 9, 1967, during which the investment credit was allowed only for pollution control facilities. Only 23 applications for this credit have been received, and these originated from only 10 different firms.

It has been shown that the proposed bills could increase total assistance to an amount as high as

70%. Even this large amount of assistance would not be enough to act as a true incentive. One could argue that pollution control has a benefit to the firm in terms of public relations. It is doubtful, however, if even this consideration could make pollution control profitable for most firms. One must conclude that the proposed [cost sharing measure] programs would not be likely to result in firms installing pollution control equipment voluntarily.

2. Cost Sharing by Government

[Another objective of cost sharing measures] might be the fulfillment of a perceived obligation or desire of government to share in the cost of achieving clean air. Present assistance has, however, been shown to be as great as 59% of the total costs, and it would not seem that additional assistance is needed to meet this objective.

3. Ease Undue Burdens to Industry

[A third objective of cost sharing measures] might be to ease any undue burden that pollution control requirements would place on industry. It is possible that even 41% of the costs of air pollution control might be too much for some firms to absorb or to regain by increasing their prices or decreasing their payments to suppliers, employees, or stockholders.

In order to properly evaluate the need for this objective, a thorough understanding of the costs and burden of air pollution control to particular firms and industries is required. Information of this nature does not presently exist to the degree that would be necessary for accurate analysis, however, some data do not exist and several studies of this kind are presently being conducted by the National Air Pollution Control Administration.

Studies that have been done in this area allow some conclusions. Burden, in these studies, was measured by comparing the costs incurred for air pollution control to the value added by the industries in question. These value-added analyses have been done for the entire country by the Working Committee

on Economic Incentives and by the authors in the Kansas City and Ironton areas. In no case was the required air pollution control expenditure greater than 1/4 of 1 percent of value added.

These facts, plus their experience in this area, lead the authors to the same conclusion reached by the Working Committee on Economic Incentives who found that:

"The need and desirability of additional assistance for industry should be judged on the basis of hardship or burden on particular industries, firms or plants (or hardship on particular communities) caused by abatement actions rather than on the burden to industry as a whole."¹

Support for Cost Sharing Measures

The literature on cost sharing arrangements is voluminous, and it has been demonstrated and repeated on many occasions that cost-sharing arrangements have extremely limited value as aids to air pollution abatement.² A more interesting and immensely more

1. Richard D. Wilson and David W. Minnotte, "Government/Industry Cost Sharing for Air Pollution Control," Journal of the Air Pollution Control Association, Vol. 19 (October, 1969), pp. 765-66. (Emphasis added.) The concluding quotation is taken from Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised). "Cost Sharing with Industry?" Washington, D.C., 1967. (Mimeographed.)

2. "Cost Sharing with Industry?" Ibid., p. 5., contains the following recommendation:

4. Across-the-board cost-sharing in the form of tax writeoffs is not recommended because it distorts the tax structure, causes the total cost of pollution abatement to rise significantly, promotes excessive use of capital equipment and waste treatment facilities, and discourages selectivity in environmental quality management. Across-the-board use of grants and loans is similarly handicapped and, in addition is subject to fluctuations in Congressional appropriations.

relevant question is why these ineffectual programs continue to receive overwhelming support from the Congress, from industry, and even on occasion, from conservation groups. There are several possible reasons for support, including the following.

Desire for Equity. There is a continual concern in Congress about the problems of small business in reacting to new legislation which is suddenly forced upon them. In many instances, legislators have attempted to ease the burden of change by providing tax incentives, guaranteed loans, and grants to industry. Unfortunately, these programs have not been very successful for air pollution control, for the many reasons indicated in previous sections. Indeed, large and wealthy corporations well known for pollution appear to benefit far more from such legislation than small firms who may be faced with extraordinary expenditures for air pollution control resulting from a very crude (and therefore inequitable) application of performance standards.

Cost Sharing as an Encouragement to Compliance. One reason given for cost sharing measures is not that they induce abatement greater than that required but that they increase compliance with the law. Widespread voluntary compliance is essential in enforcing the present prevailing approach to air pollution control.¹ It is hoped that, if carrots such as investment tax credits are added to sticks such as fines and plant closings, businessmen will be more likely to comply with the law even though

1. See Chapters 1, 2, and 3.

monitoring and inspection are admittedly very inadequate. In this sense, cost sharing measures may provide sufficient incentive (when added to the fear and embarrassment of getting caught) to make "profitable" the installation of pollution control equipment. Control will still be biased and difficult to administer, but some positive effect may certainly be expected. It is important to note, however, that cost sharing measures can only be supplements to other government policies for air pollution control. And while the proposals to aid enforcement for existing laws have been much talked about, little research has been done into their effective uses.

Moralistic Approach. A number of observers of the controversy surrounding environmental problems have noted efforts to crystalize opinion against polluters by indicating that they are in fact criminals. Henry Ford II recently commented on this moralistic approach:

One of the troubles with the moralistic approach to problems is that it doesn't lend itself to rational solutions. If something is identified as a sin, like vehicle air pollution, then obviously it should be stopped 100 percent right now. . . If you have to compromise with sin, you might as well compromise on a nice round number like 90 percent on some nice round date like January 1, 1975. . . After all, if air pollution is a moral issue, not a practical one, then there's no need to consider what's necessary, what's possible, how soon it's possible, or how the benefits compare with the costs. One arbitrary compromise is as good as another. . . .¹

1. Henry Ford II, "The Clean-Cut Issue of Clean Air," The Washington Post, November 23, 1970, p. A-16. (Emphasis added.)

Industrialists have been put on the defensive and, being unwilling to accept blame for a situation which they feel developed purely because no one recognized the problem, have attempted to mount a counterattack. One tactic is to suggest that pollution is such a big problem that everyone--business, government, and the consumer--will have to play a part in solving it. By adopting this attitude, industrialists may hope to diffuse opposition to their polluting. Support of cost sharing measures then may be an attempt to persuade Congress to share the burden, and thus accept part of the responsibility for the problem.¹

Public Relations. It has already been pointed out that the public relations aspect of pollution control may provide some additional incentive to abate to near monopolistic firms in those industries whose pollution is recognized by the public. For these few firms, cost sharing measures represent an additional incentive and, indeed, may just add on to the profits the firm already anticipates from air pollution control.

1. John T. Connor, Chairman of Allied Chemical Corp. (and former Secretary of Commerce) outlined industrial support for an investment tax credit, claiming:

Since there already is a national effort in which thousands of businessmen are participating, it seems only fair to ask government to share the financial burden of the partnership, in view of the fact that the pollution problem was ignored for so many years in the national effort for economic development.

Al Wyss, "Action Urged on Tax Credits to Meet Mounting Pollution Expenditures," Journal of Commerce, May 13, 1969, p. 3.

Because the heads of these corporations often play a substantial role in setting public opinion, they have a particular incentive to support proposals for cost sharing measures. It is obvious that a moderate stance on pollution control is politically more astute to diehard opposition. At the same time, action in terms of pollution abatement to gain public accolades is expensive (at least for the shareholders) unless the government can be persuaded to pick up a healthy portion of the tab. Industry has been fairly successful in promoting cost sharing measures. The public relations argument and moralistic approach are closely connected, and the fact that government is already paying well over half the cost of air pollution equipment is apt to be neglected by industry spokesmen.

Misconceptions. The major reason for support of cost sharing measures must clearly be that legislators and other supporters simply do not realize how little effect they have. Air pollution control is a technical subject, and its intricacies are difficult to master. In the welter of conflicting testimony from different interest groups, it is hard for legislators to separate fact from fancy. In many cases, then, they rely on remedies which have been successful in other fields. Tax reductions have been successful in stimulating construction in the past. It is not easy for legislators to appreciate that construction of profit-making facilities and air pollution control facilities require two very different approaches, particularly when industry spokesmen cloud the issue by insisting that such subsidies are important.

Summing Up

To conclude, the literature on cost sharing approaches is voluminous, and it has been demonstrated and repeated on many occasions that cost sharing approaches have extremely limited value as aids to air pollution abatement.¹

First and foremost, cost sharing arrangements are simply not effective. Reliance on these devices to encourage air pollution control not only is misguided, but would have the unfortunate consequence that ambient air standards would not be met. Even if this were not the case, cost sharing arrangements are inefficient means of achieving the necessary abatement. Firms would be encouraged to adopt relatively expensive forms of control, and the firms most able to pay the costs of abatement would be the most likely to obtain subsidies.

One of the reasons for advocating cost sharing measures has been as a method of easing the burden on industry. Present tax arrangements already cover a substantial proportion of the costs of abatement, and in most cases the remaining burden is small enough that the firm can comfortably handle the rest. For some firms, though, cost sharing arrangements might be of major importance.

1. Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised), "Cost Sharing with Industry?" Washington, D.C., 1967. (Mimeographed.), contains the following recommendation (p. 5): "4. Across-the-board cost-sharing in the form of tax writeoffs is not recommended because it distorts the tax structure, causes the total cost of pollution abatement to rise significantly, promotes excessive use of capital equipment and waste treatment facilities, and discourages selectivity in environmental quality management. Across-the-board use of grants and loans is similarly handicapped and in addition, is subject to fluctuations in Congressional appropriations."

The equity aspects of cost sharing measures have not been considered in the present study, though it is clear they should be sharply differentiated from their use as an approach to air pollution control. It is also evident that any cost sharing measure designed with equity in mind should take into consideration the inherent biases of this approach.

CHAPTER 7

ECONOMIC INCENTIVES

In economic terms, air pollution is a problem because clean air¹ has become a scarce resource; while at one time it was more than sufficient for everyone's use, this is no longer so. A polluter's action now necessarily prevents others from enjoying the use of clean air, or requires the spending of substantial sums to purify it for their own use. Conversely, the increasing demand for clean air for health, aesthetic, and associated reasons necessarily prevents others--i.e., polluters--from using air as a convenient waste receptacle. Thus, air must be rationed among its alternative possible uses.

The present method of rationing, in which the ration accorded to polluters is almost unlimited, leads to undesirable results, at least from the viewpoint of those who want cleaner air for aesthetic and other reasons. If there is to be more clean air, polluters must be persuaded in some way to limit pollution. Air pollution occurs because it is the least expensive form of waste removal available to many firms. These firms will naturally be reluctant to reduce pollution since they will incur a financial loss.

1. It is unnecessary for purposes here to define what constitutes "clean" air. Suffice to say that the definition of this term will depend on the use to which clean air is to be put. Thus, clean air is of no particular importance apart from its relation with other resources, geographic areas, progress of development, jobs and incomes, legal and institutional forms, in sum, the perceptions people have regarding its present and possible future uses.

For most economic goods,¹ rationing or resource allocation is accomplished through a market process involving buyers and sellers and prices and costs. The market process generally rations economic goods in a reasonably efficient manner. This is not so in air pollution, however, since no price has been established for clean air.² Hence, the market process which is usually relied upon to balance costs and benefits does not now perform this function satisfactorily for air pollution. The market process could, however, perform this function satisfactorily if an economic price for clean air were imposed.

Assuming that firms attempt to minimize costs, their actions with regard to air pollution will not change unless either the disposal of wastes into the air becomes more expensive than other possibilities, or other possibilities of waste disposal become

1. Clean air is an economic good in the sense that it has become a scarce resource and thus requires effort or sacrifice to obtain.

2. The present situation allows polluters to preempt the use of air at no cost to themselves, while forcing others in society to incur the costs of polluted air. This divergence between private (i.e., the polluter's) costs and social (i.e., the public's) costs is referred to by economists as "negative externalities." By now, a significant, if not substantial, body of literature has developed on this subject. Negative externalities are essentially the adverse public or social effects of private actions. They exist because market prices do not force those who cause them to bear the full consequences of their actions. Both ways of conceiving the problem--that air must be rationed among its possible uses or that air pollution is a negative externality--lead to the same conclusion: that if some mechanism could be devised to bring the consequences of pollution directly to bear on the polluters themselves, the polluters would either reduce their pollution or cease the pollution-causing activity.

cheaper.¹ An economic incentive to accomplish the former would be a tax; an economic incentive to accomplish the latter would be a subsidy.

As used here, an economic incentive is a financial² measure such as a subsidy or tax which provides a decisive inducement for at least some firms to apply techniques for the control of air pollution. A minimum requirement in this respect is that pollution control should be at least as profitable as other possible investments. One means of accomplishing the end in view is to offer a subsidy for air pollution control such that those firms whose control costs are low will find it profitable to abate. Similarly, if firms are taxed for polluting, the tax reduction to be obtained by abating will provide an inducement to install control equipment. Low taxes or subsidies are only weak incentives and would result in few, or even no firms at all, reducing their pollution. Higher taxes or subsidies would gradually induce an increasing number of firms to do so, until a state is reached when very high taxes or subsidies would act as decisive inducements for all firms.

1. There is a widespread tendency on the part of businessmen to stress their "public responsibilities." Undoubtedly, businesses abate more than is justifiable from a narrowly economic point of view, but insofar as profit considerations are a major decisional force, this additional abatement is limited.

2. There are, of course, a number of non-financial measures by which government can influence private firms to control air pollution, including regulation, bargaining or persuasion, exhortation by public officials and so forth. For example, emission standards as discussed in Chapter 3, would increase the cost of air pollution to firms through the threat of court action. Under regulation, firms will meet the expenses of complying with emission standards only if the penalties resulting from legal prosecution are stiff enough (or if the firms believe penalties will be made stiffer, if the government deems necessary) so that violation becomes so expensive that another mode of waste removal (i.e., pollution abatement) is desirable.

The economic incentives discussed here, then, are those which would provide decisive inducements for at least some firms, as opposed to the cost sharing arrangements discussed in the previous chapter which do not, by their very nature, provide a decisive inducement for any firms. Instead, from the perspective of private industry, cost sharing arrangements such as accelerated depreciation or investment tax credits merely reduce the losses on pollution control equipment. They do not make the equipment profitable.

A further characteristic of economic incentives, at least at present, is that these financial measures have not been tried in the air pollution field. Accordingly, the discussion below is limited, of necessity, to present proposals involving economic incentives (such as the tax on the lead content in gasoline) or possible applications of economic incentives from other fields (for example, the use of Defense Department-type direct contracts) for pollution control.

Broadly speaking, economic incentives can be sorted for convenience into two categories: those based upon surrogates for pollution, and those based upon emissions per se. An example of economic incentives based upon surrogates for pollution would be a tax on the sulfur content of power plant fuels. In this case, the tax on sulfur content would serve as a substitute for a tax on the pollution itself.¹ An example of economic incentives based upon emissions per se would be a system of effluent or emission fees. Such a system would involve the establishment of a schedule of fees

1. Furthermore, a tax on sulfur content would also be a surrogate in the sense that of all sulfur oxide emitters only power plants are subject to the tax.

for emitting given amounts of pollutants into the air and charging polluters on the basis of how much of what kind of pollutant had been emitted.

Surrogates for emission charges provide economic incentives to reduce pollution by some, but not all, potentially feasible means. To put the matter another way, surrogates inherently exclude at least some potential methods of reducing pollution. The tax on lead in gasoline, for example, does not provide an incentive for collection of pollutants in the exhaust systems. If the excluded methods are less expensive than the methods promoted by a particular economic incentive, the total costs for pollution control will be higher than necessary. Furthermore, if the excluded methods are of major importance in pollution control, it may not be possible, at any cost, to reduce pollution sufficiently to meet air quality goals.

An important advantage of economic incentives based on emissions is that they do not preclude any method of pollution control. As a result, each polluter can control his pollution in the most economical way. For these reasons, and because of the extensive literature on the subject, economic incentives based on emissions are discussed separately in the next chapter.

To summarize, an economic incentive is a financial measure, such as a subsidy or tax, which makes profitable the application of pollution control techniques. The distinction between the economic incentives discussed here and those discussed in the following chapter is simply what constitutes the basis for the subsidy or tax. The

economic incentives discussed in this chapter are all based upon surrogates (such as the sulfur content of fuels) for actual pollution emissions. In contrast, those economic incentives discussed in the following chapter are all based upon pollution emissions per se.

Subsidies

A subsidy consists of a payment to individuals or businesses by government for which it receives no direct products or services in return.¹ For air pollution, the purpose of such payments would be to provide to the public a service (i.e., pollution control) that cannot otherwise be profitably supplied.

As explained above, air pollution occurs at present because it is the least expensive form of waste removal available to many firms. One conceivable approach to this problem would be to offer subsidies to firms which would dispose of their wastes in other ways. In a manner analogous to the direct contracting with private firms for garbage disposal, the government might let contracts for air pollution control.

Subsidies can also contribute to air pollution control by making it profitable for firms to switch to different inputs with less potential for pollution. This can occur through subsidies for

1. In the United States, for example, Federal subsidies are given to railroads and other means of public transportation for the transportation of commuters, to farmers under the current agricultural program and to the shipbuilding industry to build ships.

appropriate inputs.¹ The proposal to subsidize the low-sulfur coal industry by increasing the depletion allowance is one such attempt and would cause an increase in the low sulfur coal mined. The proposal would also cause a decrease in the price for the coal produced so that more low sulfur coal would be used.

In the present section, the subsidies to be discussed with reference to air pollution are: direct contracting and the depletion allowance. Other similar subsidies could have been considered, but these are the only important proposals now under public discussion. In addition, the following analysis of cost-plus contracting and the depletion allowance seems sufficient to point up the major advantages and disadvantages of the subsidy approach.

Direct Contracts

If pollution control is considered to be in the public interest, government may consider purchasing it in the same manner that it purchases, say, missiles or aircraft. Direct contracts might be written to pay polluters to reduce pollution on a cost plus profit basis. This method has been used and is being used extensively in other areas of government to purchase goods and services from the private sector: as, for example, in the purchase of goods and service for national defense and the space program.

1. Alternatively, air pollution control could be made profitable by subsidizing appropriate outputs. Recent proposals that the Federal government purchase only low-pollution cars is an example of a subsidy for outputs, since the initial costs of producing such cars would fall mainly upon the government.

Direct contracting of this nature would have three important advantages. First, it would provide a net inducement for profit-making firms to control air pollution. Generally speaking, therefore, the more government spends on direct contracting, the more pollution reduced. Second, direct contracting would generally allow control requirements to be carefully specified and control programs to be carefully monitored. Third, direct contracting would offer visible evidence that government and industry were working together to solve the air pollution problem.

Biased Choice of Contracts. Despite these distinct advantages, the difficulty of administering direct contracting is a major defect. At the very least, the administration of direct contracts would substantially increase government requirements for technical staff and budgets. A more basic problem, however, is that it may be very difficult from a practical administrative standpoint to determine how much of a firm's pollution control effort should be paid for by the government. To the extent that a pollution control "package" cannot be clearly defined--in terms of a specified amount of pollution abatement at a specified price--the choice of direct contracts will be biased against certain techniques of control. These biases stem from the natural tendency on the part of both government and private industry to rely most upon those control techniques which can be most easily administered and justified.

1. Bias Against Fuel Substitution. Direct contracting tends to favor distinct facilities, which are easier for most firms (and for that matter, government) to keep track of and justify. For

example, fly ash recovery systems would be favored over a change in fuels which would decrease emissions of suspended particulates.

2. Bias Against Operation and Maintenance Costs.

Direct contracting tends to favor high initial capital costs, which are once-and-for-all and readily measurable expenditures. Purchases of land and equipment for a pollution treatment facility would be favored over control techniques involving high operation and maintenance costs.

3. Bias Against Process Change. Direct contracting favors the abatement of pollution which has already been produced--and hence is measurable--rather than the prevention of emissions through process change.¹

4. Bias Against Byproduct Recovery. Direct contracting tends to be biased against pollution control methods which may produce a valuable byproduct. When valuable byproducts are produced, it becomes difficult for government to establish a reasonable basis for "allowable costs" under direct contracts with industry. Consequently, both government and industry tend to avoid these techniques.

Reduced Cost Effectiveness. Even to the extent that pollution control "packages" can be clearly specified so as to facilitate choice of contracts, there remain some administrative difficulties

1. This bias can best be seen from a specific example. Suppose that, in constructing new facilities, a firm had the option of two production processes, A and B, where A would cause less pollution than B. The private firm, in this example, might be expected to pretend that B (the higher pollution producing process) was much cheaper than was actually the case, in order to increase the size of a potential direct contract from the government. The government, in turn, would find it difficult to determine the potential difference in price between process A and process B, or the potential difference in pollution produced by each. Hence, since the government could not conduct detailed cost-benefit analyses of each process change, it would avoid contracts in this area. Realizing this, firms would tend to turn their proposals to favor control equipment rather than process change, even though the latter might be the least expensive control technique.

which tend to reduce the cost effectiveness of direct contracting. If the government is to let contracts for air pollution abatement, it must deal directly with those who pollute. Few firms would allow anyone outside their direct control to install a pollution control process in their plant. Consequently, the choice of government with respect to potential contractors is limited. Furthermore, usually several sequential contracts will be necessary for each pollution control contract, starting with an initial feasibility study and culminating with the actual pollution abatement program. With each step, the government is more securely "locked-in." Finally, although firms other than the polluter may be involved in some of these contracts, all government contractors would be controlled by the polluter, insofar as they require access to his plant. Thus, the polluter must remain the prime contractor for the project.

This contracting procedure is closely analogous to that necessary for research and development; for example, that conducted by the Defense Department. Consequently, a description of the latter may well illustrate potential problems of cost-control.

Research and Development Contracts.¹ The Department of Defense is continually involved in choosing contractors for research and development. Initial decisions involve primary research or initial feasibility studies; hence, decisions are usually based upon the contractors' technical qualifications or proposed designs rather

1. The major reason for considering Defense R&D is that it is such a major proportion of all R&D that considerable information is available as to its difficulties. See, for example, G. R. Hall, "Defense Procurement and Public Utility Regulation," Land Economics, Vol. 44, No. 2 (1968) for a comprehensive discussion of the difficulties incurred in cost-plus contracting for defense requirements.

than price offers. Consequently, the initial choice of contractor is not entirely (or even primarily) a matter of price competition. But the modus operandi is often to let several contracts in sequence to the same contractor, starting with the initial stages of research and development, and culminating in a contract for construction and operation of the desired facilities.

There appear to be a number of advantages to using one main contractor who handles the successive contracts. The production cost advantages associated with learning curves and economies of scale are maximized. If the same prime contractor is responsible for all phases of the program, including integration and coordination, the program is likely to have lower costs and better system performance. This would be particularly true where a firm agreed to limit its own pollution. Similarly, this strategy relieves the government of administrative expenses and technical ability needed to transfer the programs from one firm to another. Using a series of contracts means that the government assumes risks. Since an entire pollution control program could be a significant portion of an individual firm's budget, firms are likely to be risk averters--to charge high prices to insure against loss. Thus, the government can accept the risks, lowering the costs to society, since loss on one contract can be more easily balanced against gain on another contract.

This method of contracting, however, tends to reduce price competition. With each contract, the government is more locked into its selection of an individual firm, whether or not it is, overall, the least cost choice. Especially since the initial choice is based

on technical grounds--for basic research--rather than an overview of pricing, price competition is minimal. At each stage after selection, firms will try to magnify the target costs, so that profits (a percentage of target costs) will be maximized. Incentive pricing (offering a bonus if the actual cost is less than the target cost) gives the firm an inducement to reduce costs, but of course, not to reduce the original target price.

Air pollution abatement must necessarily be tied to specific firms, as it would be infeasible to have an outside agency plan, construct and operate equipment for air pollution control within a factory except under the close supervision of the management. Thus, once government has a specific firm in mind (through feasibility studies), they are virtually "locked-in," perhaps more so than on defense contracts, where much of the information gained from preliminary research might be transferred to new bidders. Consequently, the opportunity exists for excessive expenses and profits.

Depletion Allowance for Low-Sulfur Coal

Representative Pucinski has recently introduced bill H.R. 19,043 (91st Cong.) into the House of Representatives. The intent is to amend the Internal Revenue Code of 1954 to allow percentage depletion at a 22 percent rate for low sulfur coal.

A depletion allowance is a tax allowance extended to owners of natural resources. The allowance permits the owner of these natural resources to deduct from his income part of his investment in those resources as they become depleted.

The proposed Pucinski provision would make the production of low sulfur coal more profitable. In this respect, the provision is essentially a subsidy--for each ton of coal mined, the producer pays less taxes--and the difference in essence is a grant.

Since low-sulfur coal production would be more profitable, more firms would be induced to begin mining. The effect would be to increase the supply of coal, thus driving down its price somewhat (though not as much, generally, as the grant per ton) so that buyers would be induced to use a greater proportion of low sulfur coal. It can be concluded that the allowance will achieve the primary purpose--more low sulfur coal--but it is unlikely to be sufficient to solve the air pollution problem.

Taxes

Taxes are universally recognized as inducements to achieve specific ends. Low property taxes, for example, are often cited as inducements to firms to locate areas where they prevail. One of the reasons for high taxation of cigarettes is the belief that such taxes discourage potential smokers. Closely related are luxury taxes--often used for revenue purposes, but more frequently justified by the principle that if people must spend conspicuously, they should pay heavily for it.

A tax is considered an economic incentive when it influences the taxpayer to change his activities, because the new combination of activities is less expensive than the old. Tariffs are imposed to persuade consumers to purchase a larger proportion of domestically

produced items; this shift occurs because consumers find domestic goods comparatively cheaper than foreign goods. With such tariffs, no decree need be issued to force consumers to "buy American." To the extent that a tax provides individuals with a new opportunity to save money or increase profits, it can be classified as an economic incentive. One method for influencing the actions of polluters would be to place a tax on pollution. Under an emission tax, some polluters might limit pollution so as to avoid paying part of the tax. Indeed, the higher the tax, the greater the likelihood that firms would find it cheaper to change their activities so as to lessen air pollution.

Emission taxes or charges are considered at length in the following chapter. But such a policy might require extensive administration and entail reliance upon monitoring devices which are not now available. Consequently, an alternative is to find a substitute tax which might accomplish nearly the same thing.¹ One such substitute, or surrogate, is a tax on the sulfur content of fuels. Such a tax would increase the cost of high-sulfur fuels much more than low-sulfur fuels, prompting some firms to switch towards lower sulfur content fuels. As well, some firms might be induced to purchase high-sulfur fuels for desulfurization, and pocket the difference in tax (if the tax, of course, were sufficiently high).

1. The reason that a surrogate, or substitute tax, is not as good as an emission tax is that it is biased against certain forms of pollution control. The tax on sulfur content of fuels does not provide an inducement to use, for example, stack gas cleaning devices (if they were available). Thus, no firm would be tempted to install such devices even if they were cheaper than the true cost of switching from one fuel to another.

Tax on Sulfur Content of Power Plant Fuels

One possible alternative to emission charges per se is to levy a tax only on major emitters whose emissions are relatively easy to measure. The main sources of sulfur dioxide pollution, for example, are electric power plants. Since they are few in number, it has been suggested that a tax be levied on the sulfur content of fuel consumed, with a rebate for sulfur collected after burning (e.g., by stack gas cleaning). The purpose of the tax would be to provide an economic incentive to power plants to reduce their emissions of sulfur dioxide. It is estimated that a tax of \$.05 per pound of sulfur will provide a sufficient inducement for power plants to switch over to low sulfur fuels. However, if the inducement is not sufficient at this level, the tax could be increased until it were successful.

A major advantage of the tax would be ease of administration, particularly in comparison with other possible types of stationary source air pollution taxes. Since 1970, electric generating public utilities have been required to report the amount and type of fuel consumed and the sulfur content of that fuel. This information is transmitted to the Federal Power Commission and could be cross-checked against similar information provided in the sulfur tax return filed with the Treasury Department. The tax would be levied on the sulfur content of fuel consumed in a year's operation, as reported to the FPC.

In addition to ease of administration, a simple tax on the sulfur content of coal and oil consumed by steam electric generating plants has several other advantages. First, it avoids the emission

measurement problem associated with emission taxes. Second, it avoids problems of determining damage and liability. Third, the tax would focus on a major problem (i.e., power plants) with minimum direct interference by government. Finally, and most importantly, since fuel substitution is relatively simple, the proposed tax would probably be a sufficient inducement for individual power plant companies to switch to low-sulfur fuels.¹

These advantages, however, must be weighed against a number of disadvantages. To the extent that control costs are not known, desired levels of control would be attainable only through trial and error. The decision would be even more difficult in that a tax on sulfur in electricity introduces a bias against stack gas cleaning devices, since the fee is based on the sulfur in fuel rather than sulfur emissions per se. Although compensation might be allowed for such devices, the effectiveness on these devices would have to be monitored, since maintenance of stack gas cleaning equipment is required.

1. "Switchovers" to low-sulfur fuels have been already initiated in several power plants. According to the New York Times, "L.I. Utility to Start 'Switchover' Plan to Curb Pollution" (September 27, 1970), two power plants of the Long Island Lighting Company will switch to low-sulfur fuel when the sulfur dioxide content in the air rises above levels to be set by the New York State Department of Environmental Conservation. An even better example concerns the Hydro-Electric Power Company of Ontario which, in response to pressure from public interest groups such as Pollution Probe, announced that the R. L. Hearn Generating Station, a 1200 megawatt thermal power plant located in downtown Toronto, would be converted so that natural gas might replace coal as a fuel during periods of high sulfur dioxide content in the air.

A more serious problem could be that electricity users would shift to other fuels, particularly high-sulfur fuels, since the effect of the tax will be that electricity rates rise while high-sulfur fuel prices will fall. Similarly, as the tax is levied only on electric power plants, they alone will shift to low-sulfur fuels. When the price of high-sulfur fuels falls as a result of this shift, other firms will find it more profitable to shift to high-sulfur fuels. In both instances, these new users of the higher sulfur fuels will pollute more than before, and may be even less efficient fuel burners than the companies. It is possible that the initial reaction of the power companies to reduce sulfur dioxide pollution will not be substantially greater than the pollution caused through the secondary changes.

Regulated Industries.¹ Although economic incentives can be expected to succeed in most industries, questions have arisen concerning their effectiveness in prompting industries subject to regulation to reduce air pollution. For several years, economists have discussed profit-maximization techniques under regulation, and have concluded that regulated industries are motivated to substitute among inputs in order to maximize the rate base.² Generally speaking, fossil-fueled power utilities can be expected to be more

1. Fred Lawrence, Economist, Office of Economics, Federal Power Commission, provided valuable insights into possible relations between air pollution and regulation.

2. H. Averch and L. L. Johnson, "Behavior of the Firm under Regulatory Constraint," American Economic Review (December, 1962), pp. 1052-1069.

capital-intensive than others. One would suspect, therefore, that these power companies would overspend rather than underspend on air pollution abatement equipment since such expenditures would be profitable as soon as the rate base were expanded.

It appears, however, that electric utilities are not taking steps to overspend on pollution control facilities. Indeed, the argument is that utilities are comparative laggards in air pollution abatement. Since the utilities evidently (at least according to hypothesis) are not acting to maximize returns, one would have to substitute an assumption that public utility managers are unable to "maximize" profits under regulation. In other words, allowing firms "fair profit" also presumably allows them to be managed in a lax manner. There is, however, little reason to believe that managers would be any more lax about air pollution abatement than any other measure. And a general lack of cost minimization must be controlled insofar as alternatives to electricity exist, and may be utilized by major users of electricity.

In other words, if the tax is high enough, then electric power plants will abate. Moreover, arguments that claim electric power companies are under no pressure to lower costs because they can just raise prices fail to take into consideration the fact that people will buy less electricity when the price is increased.

Industry in many cases supplies its own electric power, and if the price increases enough, will switch to other fuels. Even consumers will think twice about use of electricity if the price goes up. Because a power company can lose sales if prices increase too much,

only a perverse management could be expected not to minimize costs, even if such an action included air pollution control.

It might be useful, though, to consider in more detail the relationship between an environmental tax--such as the sulfur content tax--and regulated industry. The question is whether the regulatory procedure is such as to cancel the inducement effect of the tax.

Once a tax is proposed, public utilities will presumably waste no time in applying for a rate increase to cover the additional costs of the tax. Thus, the application for an increase, and even a decision, are likely to be made even before the tax comes into effect. The regulatory body may be very reluctant to grant the full increase, particularly if it is aware that the tax is high enough to allow the industry to introduce methods involving less pollution at a cost less than the rebate in tax. Thus, the regulatory body may pressure the companies to reduce pollution.

However, some resolution involving at least a partial recovery of the sulfur content tax will be made. The question becomes, therefore, what inducement would there be under the new, higher rate to reduce pollution? The main considerations would appear to be three. First, a noticeable rate increase will tend to make electric power less competitive vis-a-vis other forms of energy. Thus, electric power companies may be somewhat reluctant to avoid completely cost-cutting alternatives. Second, if changes can be made to reduce costs after the initial rate increase, it may take a few years before the regulatory agency notices their excess profits and

has time to act. During this limited period (perhaps two to three years), the investment in pollution abatement will return excess, not merely ordinary, profits. In a related situation, cost minimization on this account may offset cost increases in other areas for which the agency is slow to grant an increase. Third, it has been previously noted that the sulfur-content tax is likely to be great enough to provoke considerable efforts towards desulfurization. This seems particularly likely in the case of coal--a major source of sulfur dioxide. Consequently, the price of low-sulfur coal is likely to fall relative to high-sulfur coal, if desulfurization of high-sulfur coal becomes common, and electric power companies would need only buy more low-sulfur coal to achieve the ends of the tax.

In conclusion, there seems little reason to doubt the effectiveness of a sulfur-content tax on fuels for fossil-fueled power plants.

Tax on Lead in Gasoline

The Administration has proposed a tax of \$4.25 for each pound of lead additives that are blended into gasoline. The tax would price the new unleaded gasolines coming onto the market competitively with the standard types of leaded gasolines that are responsible for a substantial degree of air pollution. Thus, the main purpose is not revenue but the creation of an inducement that would speed the process toward low-lead or lead-free fuel, according

to the proposal.¹ Congressional opposition was sufficient to have the bill discarded, but the Administration has indicated its intention to reintroduce a similar bill in the 92nd Congress. There will still be questions about the level of tax; members of the House Ways and Means Committee feel that if the tax is to be prohibitory, it should not be passed. "Hale Boggs, of Louisiana grandly puts it: 'We don't believe the power to tax should be used as the power to destroy.'"²

An adjustable proposal that would increase taxes on leaded gasolines but decrease taxes on unleaded fuels, so that there was no net change in tax revenues, would be too cumbersome to set up and collect, according to an Administration spokesman. Consequently, the tax will be passed on to the consumer, and will cost motorists about \$1.6 billion each year.

According to the Administration, lead in the atmosphere is likely to become a human health hazard, though it has not yet become conclusively established as one. Furthermore, unleaded gasoline is considered to be essential for the effective operation of future automobile exhaust emission control devices aimed at curbing carbon monoxide and oxides of nitrogen.

1. The primary purpose of the proposed tax, however, has been the subject of some confusion, owing to conflicting statements by Administration spokesmen. Appearing before the House Ways and Means Committee on September 9, Treasury Secretary David M. Kennedy said that the government "desperately" needed the revenue such a tax would produce in the immediate future--about \$1.1 billion in the present fiscal year if the tax had been made effective by October 1. See "Tax on Lead in Gasoline Called A Key to Clean Air," New York Times, September 9, 1970, p. 1.

2. Newsweek, August 10, 1970, p. 13.

The Administration believes the tax would help smooth out the "difficult transitional problems" that have and will continue to arise as leaded gasolines are gradually phased out of use and replaced by the unleaded products. These problems include the meeting of stiff new Federal air quality standards, the redesign of automobile engines to use the lower octane unleaded fuels, the changing of refinery equipment to produce unleaded gasoline, and the construction of storage and transmission facilities for the new products.

In some respects, the proposed tax may remove the dilemma of oil refining companies on the issue. Since the automobile companies announced plans to design most 1971 cars specifically for the use of lead-free, or low-lead fuels, the oil-refining industry has come out with a wide variety of low-lead or lead-free gasolines. While nearly all companies have offered new brands, with widespread publicity, the response from motorists has been limited after the initial good reaction to the new fuels.

The main reason for apathy toward the new gasolines is probably the higher price. Most new fuels sell for one to three cents a gallon higher than the leaded regular versions; the difference is due to refining and selling costs. The Administration's lead tax in effect will remove this difference by adding about 2.3 cents to the price of a gallon of leaded gasoline. However, if the current price war in a non-leaded gasoline continues, the need for a tax may diminish.

A number of controversies surround the issue of lead in gasoline. The oil industry, despite offering the new brands, is not convinced that lead-free gasoline will necessarily supplant the present variety. Lead producers, naturally, are even stronger in their opinion that lead will continue to be an important fuel additive, and point out studies by the Bureau of Mines showing that lead-free fuel may actually increase total pollution, since new contaminants would replace the lead; and, the automobile manufacturers seem convinced that lead in exhaust fumes will make it impossible to develop catalytic exhaust purifiers in time to meet Federal emission standards that take effect in 1975.

Another factor in the switch to non-leaded gasolines is the question of the effect on present automobiles. The new 91-octane gasoline is three octane points below regular and nine below premium gasolines. Thus, while most cars could use the no-lead gasolines, engine adjustments might be necessary to eliminate knocks. In addition, General Motors engineers have found unleaded fuels can wear down engine valve seats. Shell Oil has put an additive in its gasoline to prevent valve damage. Other oil companies feel the effect is negligible; the effect of the various controversies is to limit the enthusiasm of prospective buyers.

The question of a lead tax brings up a number of questions which must be resolved. Are motorists being penalized more or less than other polluters per unit of pollutant? If lead has not been proven dangerous to health, might it not be more appropriate to place a tax on cars which do not control the emission of all

pollutants? Has the controversy about lead been fomented by automobile producers to shift the burden of pollution-control to oil producers, even if this is less efficient to the country as a whole?

Tax on Electricity

Fossil-fueled electric power plants have long been visible examples of industrial air pollution. A current bill in the Senate of Maryland (No. 682) proposes "an environmental surcharge of 0.5 mills per kilowatt hour with revenues to be placed in an Environmental Escrow Fund to be used to carry out the provisions of the Act."

The funds would be spent largely on a research program for the evaluation of electric power plant sites and related considerations of environmental and land use. Eight percent would be set aside for acquiring options on sites and also sites for electric power generating facilities within the state, and two percent would be set aside to provide extraordinary environmental quality control devices deemed essential by the Secretary of Health and Mental Hygiene or Natural Resources. The bill also provides for the purposes of the Act.

Interestingly enough, the surtax suggested, 0.5 mills per kilowatt hour, is of the same magnitude as the average effect of the tax on sulfur dioxide proposed by the Council of Economic Advisors (0.7 mills per kilowatt hour).¹ Thus, it is imperative to consider the tax in terms of its effect on reducing pollution, rather than just in terms of its revenue generating capacity.

1. See following chapter on emission charges.

Since the tax is levied on output of electricity, regardless of actual pollution levels, it can have no effect on the plans of the electric utilities to reduce pollution. Consequently, it is not as efficient as either the sulfur dioxide tax, or the tax on sulfur in power plant fuels. However, some effect might occur as electricity users start to switch towards other, now less expensive fuels.

Federal Financial Coercion

The Federal Government wields considerable economic power through its various financial activities, including federal loans, grants, contracts, lease arrangements, licenses and permit programs. One possible approach to air pollution abatement, then, is for the government to refuse to deal with anyone who is unable to meet air pollution abatement objectives.¹

These programs act indirectly as an economic incentive because firms decide whether it was more profitable to abate in order to deal with the government or more profitable not to abate and therefore deal only with the private sector. Generally speaking, those firms which chose to deal with the government would have to

1. The most comprehensive (yet concise) description of pollution caused by recipients of federal programs is for the area of water pollution and is contained in a 1967 Task Force report prepared in response to a Presidential Executive Order. See U. S., Department of Interior, Report and Recommendations for Effective Utilization of Federal Loan, Grant, Contract, Lease, License and Permit Programs to Assist in the Attainment of the Nation's Water Pollution Control Objectives (Washington, D.C.: Government Printing Office, 1967).

raise their prices to cover the cost of air pollution abatement, and the government would find it could meet the objectives of the various programs only by paying substantially all the costs of abatement.¹ Since the government deals in unequal propositions across various segments of the economy, different industries would be under differential pressure to abate; thus, this form of economic incentive is a surrogate incentive.

These various forms of relationship between government and the private sector constitute a significant economic force. Consequently, were the government to pursue air pollution control vigorously through its purchasing power, virtually all areas of the country would benefit from a reduction of air pollution. However, the probability is that the government's economic power is reflected differentially throughout the country and does not coincide with community needs for air pollution control. It follows, therefore, that the total costs of air pollution might be very high because the Federal Government would have to pay for pollution control, through higher priced contracts, even in areas with minimal need. On the other hand, the regulations are not likely to be sufficiently strict as to result in significant abatement in heavily polluted parts of the country.

Another effect would be a division in the normal competitive market between those firms which bid for Federal Government contracts and those which do not. The latter will generally be located in

1. This assumes, again, that these programs are imposed in and of themselves, not as supplements to other measures.

heavily polluted areas which, therefore, will obtain even less benefit from this government policy. Other programs that match more closely air pollution control to needs in each region of the country may prove far less costly and at the same time produce more effective abatement results. For these reasons, air pollution abatement through Federal Government purchasing power (assuming these programs can be administered) must be considered as supplementary to other methods, rather than as a policy in itself.

Summary and Conclusions

Economic incentives provide the necessary profit motive to influence the actions of industry. The economic incentives discussed here include both taxes and subsidies, but all have the potential to influence firms to abate pollution. However, many may have to be rejected as administratively infeasible. In general, low taxes or subsidies will influence few firms to abate pollution, while high taxes or subsidies will influence many firms to take appropriate action. However, because there are biases involved, in that some methods of control are excluded from consideration, the total cost of controlling air pollution might be much higher than necessary.

Thus, economic incentives must be distinguished from cost sharing arrangements. The latter must be supplemented by other inducements; this is not so with incentives.

The chapter has considered a special class of economic incentives: those which only indirectly influence actual levels of emission. These have been called surrogates, in that they provide

an economic incentive to change an activity in a manner which indirectly causes pollution reduction. Some of these surrogates, such as the proposed depletion allowance for low sulfur coal, have limited applicability. In general, however, the economic incentives discussed are advantageous, but only as a pale substitute for emission charges. Indeed, the tax on sulfur emitted by power plants is a quasi-emission charge. Therefore, the conclusions regarding emission charges in the next chapter can be attributed to economic incentives, although to a lesser degree.

CHAPTER 8

EMISSION CHARGES

As defined in the previous chapter, an economic incentive is a financial measure such as a subsidy or tax, which makes it profitable for a firm to apply techniques of pollution control. Thus, for example, taxing pollutants would have the effect of making it more costly for firms to pollute the air. When taxes are imposed, some firms will decide that alternative ways of waste disposal are cheaper than air pollution and will accordingly reduce their pollution. As President Nixon has said, "A charge on sulphur emitted into the atmosphere would be a major step in applying the principle that the costs of pollution should be included in the price of the product."¹ A low tax or subsidy will induce relatively few firms to make changes; however, as the tax or subsidy is increased it becomes a decisive inducement to more firms, and at a very high level of taxation, all firms will find extensive pollution abatement profitable.²

~~Whereas the previous chapter dealt with economic incentives~~
based on surrogates for actual emissions--surrogates such as the

1. President Richard M. Nixon, 1971 Message to Congress, February 8, 1971.

2. Thus, the defining characteristic of economic incentives is that these financial measures provide a decisive inducement to firms for the application of control techniques. In contrast, subsidies, such as accelerated depreciation or investment tax credits merely reduce the losses on pollution control equipment but by no means make the equipment profitable.

sulfur content of power plant fuels, for example--the present chapter treats those economic incentives based on the emissions per se. An example of this latter category of economic incentives would be a charge on emissions where each polluter would be required to pay a tax per ton of pollutants emitted. Specific proposals for this type of economic incentive based on actual emissions are discussed later in this chapter.

What Is An Emission Charge?

As applied to air pollution, emission charges would involve the establishment of a schedule of charges for emitting given amounts of particular pollutants into the air. Each polluter would then pay a certain charge to a pollution-control agency according to how much and what kind of pollution he has emitted. The schedule of charges could be adjusted upward or downward to reach any desired level of ambient air quality.

For present purposes, emission charges can be considered as a form of regulation since they are a means of coercing polluters to curb their actions in the public interest. Pollution is reduced because emission charges are an economic penalty which is set so high that it is to the polluter's pecuniary advantage to reduce his pollution. The level of charges could be set in the same manner that an emission standard is set, that is, with regard to air quality

criteria.¹ Their purpose is thus identical to emission standards or other regulatory devices.²

An emission charge may well be compared with a user charge, of which the gasoline tax is a ready example. In this instance, the money collected from road users is put toward the cost of building roads. Similarly, individual users are often charged for water, for sewage disposal, for garbage collection, and for national parks. An emission charge is a user charge in the sense that a polluter would pay for the use of the environment for waste disposal. This analogy--between environmental emission charges and user charges--has been recognized in a recent authoritative Federal Government report.

There is considerable experience with the user charge for industrial waste treatment service in collective public facilities. It has been successful in providing revenues to communities for replacement facilities, in encouraging sound industrial waste treatment practices, and in . . . providing a businesslike way of managing a vital community service. Some pollution control experts see the establishment of regional waste treatment facilities for the acceptance of all wastes on a user charge basis as the appropriate solution to the water pollution control problem.

1. In addition, the level of charges could be set to take account of control feasibility or other considerations. Eventually, the level of emission charges could be set to the extent possible on the amount of damages (or costs) estimated to result from air pollution.

2. A secondary feature of emission charges is that they are also a source of revenue. However, this aspect should be separated from the regulatory effect of the emission charge. The problems of who would collect such revenues and how they would be dealt with--in particular the possibility of earmarking emission charge revenues--will be discussed below.

The regional facility would be operated in accord with the hydrologic situation and environmental standards.¹

At least some executives are willing to concede that air is a "free" input into their operations. John E. Esposito recounts an incident which demonstrates this quite well. "In an unconscious but quite revealing way, a steel company executive told the Task Force, 'We use a lot of air. . . in our business.' This was a tacit recognition that the Nation has been providing American industry with a public subsidy by permitting the unpenalized use--and contamination--of our air."²

As indicated above, there has been considerable experience with and discussion of the emission charge approach. The present chapter will discuss these experiences and proposals, concentrating first on effluent charges used in water pollution, and then on potential applications of this approach--through the establishment of emission charges--to the control of air pollution. In addition to emission charges, there are two other forms of economic incentives based upon emissions per se. One possible approach would be to utilize emission subsidies rather than charges (which constitute, in effect, a tax). Another approach would be to institute a market for

1. Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised). "Cost Sharing with Industry?" Washington, D.C., 1967, p. 35. (Mimeographed.) The report continues, "However, waste treatment facilities on a collective basis are less applicable in the case of air pollution control." This consideration, not central to the immediate discussion, will be discussed later in the present chapter.

2. John C. Esposito, Vanishing Air (New York: Grossman Publishers, 1970)

permits based upon the extent of emissions. Both approaches, which are relatively novel and therefore not widely discussed, are treated toward the end of the present chapter.

Who Is Interested?

Emission charges have been popular with economists since Pigou's first celebrated attempt to resolve the externality problem.¹ More recently, a number of economists have advocated emission charges to reduce air pollution, among them Mills, Ruff, and Vickrey.² Kneese of Resources for the Future is perhaps the foremost authority on this approach as applied to water pollution. He has written extensively about their use emphasizing particularly the Ruhr Valley

1. A. C. Pigou, The Economics of Welfare (4th ed.; New York: Macmillan, 1952). Pigou theorized that if an appropriate tax were placed on smoke emission, the "negative externality" problem could be resolved. "Negative externalities" are essentially the adverse public or social effects of private actions. They exist because market prices do not force those who cause them to bear the full consequences of their actions. The present situation allows polluters to preempt the use of air at no cost to themselves, while forcing others in society to incur the costs of polluted air. This divergence between private (i.e., the polluter's) costs and social (i.e., the public's) costs is referred to by economists as a "negative externality." Emission charges would have the effect of increasing the cost to the polluter so that he makes a more appropriate decision, i.e., decreasing pollution.

2. Edwin S. Mills, "Economic Incentives in Air Pollution Control," The Economics of Air Pollution, ed. by H. Wolozin (New York: Norton, 1966); Larry E. Ruff, "The Economic Common Sense Pollution," The Public Interest, No. 19 (1970), pp. 69-85; and William S. Vickrey, "Theoretical and Practical Possibilities and Limitations of a Market Mechanism Approach to Air Pollution Control," (Address to Air Pollution Control Association Meetings, Cleveland, June 11, 1967).

effluent charge scheme in Germany.¹ And one of the first attempts to study seriously the administrative feasibility of emission charges for air pollution has just been completed by Low-Beer.²

The interest in such charges has been growing beyond the circle of professional economists. A study conducted by IPA in 1965 for the Department of Health, Education and Welfare considered the use of effluent charges,³ as did a 1967 study for the Water Quality Office.⁴ Even more recently, a National Academy of Engineering Study, now in draft form, is one of the first serious attempts to analyze emission charges for both point source and mobile source polluters.⁵ Likewise, the influential journal, Science and Public

1. Orris C. Herfindahl and Allen V. Kneese, Quality of the Environment: An Economic Approach to Some Problems in Using Land, Water, and Air (Baltimore, Md.: Johns Hopkins Press, 1965); Allen V. Kneese, The Economics of Regional Water Quality Management (Baltimore, Md.: Johns Hopkins Press, 1964); Allen V. Kneese and Blair T. Bower, Managing Water Quality: Economics, Technology, Institutions (Baltimore, Md.: Johns Hopkins Press, 1968). Although the approaches are essentially similar, the term emission charge is usually used in connection with air pollution, and effluent charges in connection with water pollution. The Ruhr Valley scheme is discussed in more detail below.

2. Anthony B. Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources (unpublished Ph.D. dissertation, Columbia University, New York, 1970).

3. Institute of Public Administration, "Industrial Incentives for Water Pollution Abatement," A Report to the U.S. Department of Health, Education, and Welfare, Washington, D.C., 1965. (Mimeographed.)

4. ABT Associates, Inc., "Incentives to Industry for Water Pollution Control: Policy Considerations," A Report to the Federal Water Pollution Control Administration, Washington, D.C., 1967. (Mimeographed.)

5. Committee on Public Engineering Policy, National Academy of Engineering, "Strategies for Pollution Abatement," Washington, D.C., 1970. (Mimeographed.)

Affairs recently published an article promoting a "pollution tax" upon polluters on the basis of damage caused by their pollution.¹

Congress first considered a charge approach in connection with a bill on water pollution submitted by Senator Muskie in 1966. The bill would have provided for effluent charges, but the testimony on the provision was particularly limited and, after summary attention to the provision, was abandoned.²

Four years later, Senator Proxmire proposed a nation-wide scheme of effluent charges to finance the upgrading and extension of waste facilities, arguing that:

The effluent charge approach has the virtue of simplicity--the less you pollute, the less you pay. It has the virtue of fairness--all industrial polluters will be covered, and the cost of waste disposal will be regarded as what it should be--a legitimate cost of production. But most important of all, effluent charges have the virtue of effectiveness--they work.³

The tone in 1970 was in contrast to the testimony in 1966. Whereas skepticism was widespread in the earlier hearings, the Proxmire provisions regarding effluent charges received almost overwhelming support in testimony. While the bill did not survive the crush of business at the end of the 91st Congress, it appears certain that

1. Norman F. Ramsey, "We Need A Pollution Tax," Science and Public Affairs, Vol. 26, No. 4 (1970), p. 3.

2. An analysis of Congressional hearings on effluent charges is included in Appendix B.

3. U. S., Congress, Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2d sess., p. 188.

there will be continued Congressional consideration and that enthusiasm for the charges approach will increase further.

Similarly, the attention accorded the charges approach has been growing in the executive branch. An interagency task force in 1967 considered effluent charges favorably, suggesting that demonstrations would be very useful.¹ Government officials (though in an unofficial capacity) have commented favorably on such a demonstration.²

Until very recently it seemed that support for the charges approach was much more substantial for the control of water pollution than for the control of air pollution. However, considerable research has been conducted, initially by the Air Pollution Control Office and more recently by several other government agencies, into the prospects for a charge based on the emission of sulfur oxides.

This history of quiet but thorough research has recently surfaced in a dramatic manner. In January, 1971, it was reported that the Treasury Department and the Council on Environmental Quality had jointly worked out a proposal in hopes of persuading the President to include it in his message to Congress on the

1. Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised). "Cost Sharing with Industry?" Washington, D.C., 1967. (Mimeographed.)

2. For example, Douglas B. Wilson of the Office of Management and Budget commented on "Tax Assistance and Environmental Pollution," Tax Policy, Vol. 37, Nos. 7-8 (1970), p. 11, that "Certainly it is wise to state that effluent and emission fees should be tried in demonstration projects and experimental programs during 1970." See also, Paul H. Gerhardt, "Incentives to Air Pollution Control," Law and Contemporary Problems, Vol. 33, No. 2 (1968), pp. 358-368.

environment.¹ Apparently, the President was particularly impressed with its use as an economic incentive to control air pollution. The President's 1971 Environmental Program states:

With no technology currently available, industry does not have an incentive to invest in control equipment until it has been tested for some time. Enforcement at all levels of government is likely to be hampered by arguments on technical feasibility. An economic incentive would provide pressure for industry to demonstrate and use technology as soon as possible to avoid the charge. It would also provide an incentive to achieve even higher levels of abatement than required by the standards. As such, it will provide a powerful tool to help achieve the air quality standards called for by the Clean Air Act.²

The Council on Environmental Quality and the Treasury Department have been directed to develop a "Clean Air Emission Charge" on emissions of sulfur oxides.³ Given this demonstration of the value of emission charges in administering an air pollution control program, it is not unlikely that proposals to levy a charge on other pollutants may follow, and indeed there may be renewed support for charges for other environmental problems.

What Are the Apparent Advantages?

Advocates of emission charges have argued that this approach offers a number of advantages over other forms of regulatory control.

1. Eileen Shanahan, "U.S. Tax Proposed on Fuel Sulfur," New York Times, January 10, 1971, p. 1.

2. The Domestic Council, Executive Office of the President, The President's 1971 Environmental Program: Controlling Pollution (Book One). Washington, D.C.: Government Printing Office, 1971, p. 2.

3. Ibid.

First and foremost, as pointed out in the President's Environmental Program, emission charges are effective. And, as experience with effluent charges for water pollution control indicates, firms react to charges by attempting to reduce wastes, either through changing processes or by actual treatment.

It is also argued that emission charges would encourage the most efficient means of controlling air pollution. There is no bias towards a particular control technology as there may be in other methods of control. A related advantage would appear to be that there would be far less government "interference" in the internal operations of the plant. This is because an emission charge system allows the firm to reduce pollution in whatever manner it chooses, as long as the pollution is reduced.

Another advantage is flexibility. Depending on the amount of control desired, the level of charges can be adjusted to achieve any ambient air quality.¹

Last but not least, emission charges are compatible with existing approaches to air pollution control. For example, the air quality control regions and ambient air standards that are emerging under current control programs could also be used to administer

1. While a simple emission charge system could be implemented with a relatively crude monitoring system, a more sophisticated monitoring system would be needed to make emission charges as flexible as they should be. Those areas of the country which have more need for pollution control than other areas will require higher emission charges (and more sophisticated monitoring systems) than would lower pollution areas. The advantage of emission charges is that these differing needs can be accommodated through different levels of emission charges.

emission charges. Used in this way, emission charges could be a valuable regulatory supplement to current approaches to air pollution control.

What Needs to Be Known?

Considering the interest and advantages in this approach, emission charges appear to be an idea whose time has come. But the fact remains that emission charges for air pollution control have yet to be tried. We are at a juncture with a promising idea, but one whose implementation may be faced with numerous potential pitfalls.

A recurring objection to the emission charge approach is that such a scheme constitutes a "license to pollute." Although the exact nature of this criticism is not always clear, its thrust appears to be either that the levels of emission charges would be set unreasonably low (so that few polluters would have an incentive to stop polluting) or that pollution could continue as long as the polluter paid his fine. In essence, however, both objections boil down to the same question--whether the charge would be set high enough to discourage further pollution. The administrative corollary to this question is how would the level of charges actually be set (e.g., by legislation, administrative action, etc.) and how would it be determined that the charge has been set at a high enough level.

A second objection to emission charges is that they would be an unfair penalty imposed upon industry. Industry spokesmen,

for example, have argued that instead of encouraging pollution control, emission charges would actually decrease industry's willingness to respond. Certainly, industry would be quite reluctant to pay a new tax, whatever the justification given. On the other hand, the advantages of this approach to industry may be considerable, particularly in comparison with alternative approaches. How emission charges are presented, and what relations there would be between the air pollution control agency and polluting industries, are therefore questions of paramount importance.

Finally, there are several questions which can be summed up in the objection that emission charges would constitute an "administrative nightmare." In some forms, of course, this objection is correct. For example, if each polluter in a city were assessed charges that varied hour by hour on each of half a dozen major pollutants, the result would be havoc. However, the real question to be answered (as opposed to the hypothetical objection above) is whether emission charges can be instituted that are simple to administer, simple to understand, and most important, simple to react to.

The answer to this question hinges upon the solution to a number of detailed problem areas, such as monitoring needs, the most desirable institutional arrangements, legislative requirements, etc. Many of those who support emission charges in principle contend that this approach is not feasible in practice since the solutions to their detailed problems have not been settled. All this points to the need for detailed analysis of the administrative

feasibility of emission charges in order to provide the background information necessary for the formulation of future policy.

Effluent Charges for the Control of Water Pollution

The use of effluent charges (often in the form of user charges) to solve the problem of water is not new. It is quite common for American communities to charge for garbage disposal. The effluent charge is simply a more sophisticated form of this traditional approach, since effluent charges would be based upon both the quality and quantity of waste discharged, rather than on a simple flat rate.¹ Consequently, effluent charges would also require a more complex monitoring capability to administer the more sophisticated approach.

Before proceeding, it should be noted that not all aspects of effluent charges for the control of water pollution are relevant to the control of air pollution. Much of the literature and public discussions of the Ruhr Valley effluent charge approach, for example, has emphasized that large scale, centralized water treatment facilities are frequently cheaper than treatment facilities at each individual plant. This aspect, however, is irrelevant for air pollution control, since air, unlike water and solid waste, cannot be centrally treated. Hence, air pollution control must be on a

1. The traditional approach is much more simple. Sewer charges, for example, are usually based upon a fraction of water charges, the frontage of the building being served, or some equivalent flat rate method.

source by source basis, rather than through centralized treatment facilities.

Likewise, literature on the French approach to effluent charges--and in particular the French legislation that divides the nation into six major river basins--has focused on the classic example of water pollution, which involves an upstream polluter damaging a downstream community. The logical area in dealing with water pollution is a river basin; the logical geographic area for dealing with air pollution is much less clear. Hence, the great attention often devoted to organizing water pollution control according to major river basins is not relevant to air pollution control.

In reviewing the relevance of effluent charges for air pollution control, it should be emphasized that much of the literature and public discussion on the subject has tended to obscure a third aspect of this approach which is of primary importance for air pollution control; this is that firms react to effluent charges by reducing their effluent and/or increasing treatment of their wastes.¹ Since this inducement effect is especially important for our present purposes, we give particular attention to it below,

1. This inducement to polluters has been extremely effective, although it tends to be relegated to a secondary position in most of the literature. For substantiation of the inducement effect, see for example, Allen V. Kneese and Blair T. Bower, Managing Water Quality: Economics, Technology and Institutions (Baltimore, Md.: The Johns Hopkins Press for Resources for the Future, 1968), p. 252. The important citation in this regard is quoted below in this chapter. Also, see U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2d sess., p. 188 ff.

subordinating other considerations that are less relevant to air pollution.

Ruhr Valley Genossenschaften

The Ruhr River Valley is located in western Germany, somewhat to the north of Bonn. The area's population is approximately 10 million, or about 15 percent of the national total; but the valley accounts for about 40 percent of the industrial activity in Germany and about 70 percent of the coal, coke, iron, and steel industries. It is one of the most concentrated industrial areas in the world.¹

During the past 60 years, the Valley has become increasingly involved in the management of water quality as water use has grown in response to industrial activity. The Ruhr Valley Genossenschaften, or River Assemblies, have come to be regarded as striking examples of the cooperative approach to water quality management. While there are many water associations throughout Germany, specific laws passed between 1904 and 1958 created eight large multi-purpose river basin authorities with extensive ability to plan and execute major schemes for water quality management, involving waste disposal, water supply, flood damage reduction, and land drainage.

The Genossenschaften are under the general supervision of the Ministry of Food, Agriculture and Forestry of the State of

1. Discussion of the Ruhr River Valley System, the French system, and others is based upon the detailed examination of these approaches in Allen V. Kneese and Blair T. Bower, Managing Water Quality: Economics, Technology and Institutions (Baltimore, Md.: The Johns Hopkins Press for Resources for the Future, 1968), Chapters 12-13.

North Rhine-Westphalia. However, control is generally limited to ensuring that their activities do not expand beyond the broadly worded enabling legislation.

One of the largest of the Genossenschaften is the Ruhrverband, which has built over 100 waste treatment plants and also manages several large upland reservoirs, waterpower facilities, and a series of shallow oxidation lakes. Construction funds are borrowed. The annual expenses of interest, operation, maintenance, and normal replacement are met by a system of effluent charges.

The costs of constructing the system are borne by both water polluters and water users (e.g., boating enthusiasts). The Genossenschaften, then, are comparable to cooperatives, except that membership is compulsory and voting is distributed in accordance with the financial levies imposed upon the members. Consequently, the major participants include municipal and government districts, coal mines and industry. Usually, hundreds of voters are included in each assembly.

System of Charges. A comprehensive system of charges has been worked out to pay for the overall management of water quality. These are based on a formula in which the charge depends upon the amount of dilution that waste would need to undergo to be habitable by fish. The charges are used to pay for the sewage lines and sewage treatment plants; some new industries, however, may be charged special levies for particular expenses, such as new sewage lines.

Water supply, as part of the overall management of water quality, is also paid for through these charges. All the costs of building reservoirs, transmission facilities, and operations, are borne by water users according to metered use. In addition, a 45 percent surcharge is levied on construction costs for reservoirs (generally defined as any expenditures directly involving water collection or treatment, not including transmission) because water users are the main beneficiaries of keeping the rivers very clean. This approach of charging water users who require clean water is very interesting since it brings out the reciprocal nature of the rationing process; one group may have cleaner water only if they deprive the other group of its use for more waste. Consequently, charging both groups tends to lessen their demands to the point where an accommodation can be made.

Classification of Rivers. Another distinctive feature of the Ruhr Valley Gennossenschaften is the classification of rivers. The Ruhr River is kept clean enough for drinking. However, the Lippe, with a higher salinity, is used for recreation while the Emscher is primarily, in effect, a natural sewer. For this use, the Emscher has been landscaped (so as to appear aesthetically pleasing) and completely lined with concrete (so that raw sewage can be collected and treated at a downstream large-scale plant). This classification, according to use, is possible only because these rivers are tributaries to the Rhine and are thus close to one another. Consequently, those people living near the banks of one

river can easily meet their drinking needs from one and their recreational needs from another. Indeed, some of the waste from the Lippe is transferred to the Emscher. In addition, of course, this classification scheme requires considerable interdependence between the water authorities and other planning agencies since heavy polluters must be encouraged to locate on the Emscher.

How Much Pollution? The major purpose of the Genossenschaften is to ration water among its different uses. In the rationing process, a number of interrelated issues must be resolved, whether by action or by inaction. An initial question which must be resolved concerns the amount of pollution to be allowed. For water pollution, the question consists of two parts: first, how much pollution may be allowed to enter the rivers; and second, how much of the pollution allowed to enter should be cleaned by central treatment facilities.

A distinctive feature of water pollution is that there are economies of scale in central treatment facilities. Furthermore, these economies are increased when a single operating authority can take advantage of particular (as well as seasonal) conditions on a river to optimize the treatment ability of several plants.

For the Genossenschaften, the question of how much pollution to allow is solved in an incremental manner. The Assemblies decide how much pollution should be removed through central treatment facilities. This involves an implicit cost-benefit analysis: will a new treatment plant cost less than a cleaner river is worth?

Since the cost of the new treatment plant is covered by increased user charges, each polluter then has an opportunity to decide if he wishes to continue to pollute as much. If some pollute less, then river pollution is controlled by even more than the reduction achieved by the enlarged central treatment system. If the new levels of pollution in the river are felt to justify even more central treatment facilities, the process is repeated.

Who Should Use Water? Once decided the amount of pollution allowed into the water, a second question involved in the rationing procedure is who should be allowed to use the water. In principle, two alternatives are available: (1) to regulate water quantity for each consumer (by establishing standards for water supply or pollution) or (2) to place a price on water use so that each user makes up his own mind. The Genossenschaften use the latter method with the price charged being set sufficiently high to cover the costs of the central treatment facilities.

The advantage of using effluent charges over other forms of charges--such as property taxes--is that charges influence the polluter to reduce pollution (if the private cost of doing so is less than the social cost, as approximated by the effluent charge).

Inducement to Industry. In fact, industry has been quite responsive to effluent charges in the Ruhr Valley. While the Emschergenossenschaft itself operates phenol recovery plants, it appears that industry could do the same thing, except the authority has the lower costs in marketing, staff and research of a centralized

operation. This inducement effect has been documented by one authority as follows:

Salvage of iron sulfate and sulfuric acid from the waste-water of the Ruhr's iron and steel industry is another example of intensive waste recovery. Of the total amount of industrial acid used in the Ruhr Valley, almost 40 percent was recovered in 1966. Recovery is usually carried on at a loss, but it still tends to be a considerably cheaper method than treatment by neutralization. The incentive for recovery is a combination of effluent charges and technical marketing assistance offered by the Ruhrverband. One steel plant at Dortmund introduced water recirculation, internal treatment, and materials re-use processes and virtually eliminated effluent from the plant. The incentive in this case was a combination of intake water costs and effluent charges. Other iron and steel plants in the area are gradually adopting measures to reduce their water intake and wastes generation.¹

While the price charged by the Genossenschaften is likely to be somewhat different from the optimal theoretical price, one can certainly say it is "in the ballpark." The question is more difficult if addressed to air pollution. Since central air treatment plants do not exist, there is no obvious set of facilities which might serve as an appropriate base for charging emission fees. However, emission charges for air pollution control might still be used since the incremental approach remains satisfactory; the charge can be raised or lowered until it corresponds to some sort of optimal economic level. Nevertheless, the use of the funds collected and the method of changing the price would still have to be resolved.

1. Allen V. Kneese and Blair T. Bower, Managing Water Quality: Economics, Technology and Institutions (Baltimore, Md.: The Johns Hopkins Press for Resources for the Future, 1968), p. 252.

Other Considerations. Other questions connected with rationing the water supply involve considerations of when and where pollution will be allowed. For the Ruhr Valley Genossenschaften, there are two principal interrelated issues. First, how should the central treatment system take into consideration variations in pollution due to changeable industrial activity, river characteristics, and seasonal changes; and second, how should the polluters themselves react to these differences?

Because a single authority manages the central treatment system, it is able to conduct the necessary research and development to ensure that treatment facilities are located in appropriate locations to provide maximum complementarity. Consequently, with full information about stream conditions and each plant's treatment procedures, sewage treatment can be maximized.

But part of the burden could conceivably be carried by individual polluters. If the charges varied according to economic costs, firms might be persuaded to relocate along the river to aid in efficient treatment. Similarly, during periods of high waste flows, if prices were raised some firms might delay the release of waste until a more opportune time. The effluent charges of the Genossenschaften, however, take no account of these factors in the user charge system they have developed. As outlined previously, charges are based on physical parameters rather than economic costs.

This charging scheme represents a disadvantage in the control of air pollution since the inflexibility of polluters cannot in any way be compensated for by the operating procedures of central

treatment. Consequently, if emission charges are to be used in air, consideration should be given to allowing them to vary by location as well as by time period.

The French Experience

French legislation for the control of water pollution has been passed at the national level of government. The original legislation was the Dangerous, Objectionable, and Unhealthy Establishments Act of 1917. Inspectors were appointed under the supervision of the Prefect--the chief administrator of a department or administrative district--who tended to negotiate solutions to problems involving safety, health, or the amenities of a community. Fines were stiff and therefore rarely utilized.

Increasingly, however, this approach to dealing with industrial water pollution has fallen out of favor with the French. Consequently, research into more effective solutions was initiated (especially into areas of hydrologic interdependence), and the possibilities considered for economies of scale in building large sewage treatment plants. In addition, the French studied at length the experiences of the English River Boards and Ruhr Valley Assemblies.

In 1964, the French parliament passed a major new act establishing agencies in each of six river basins. The agencies were empowered to implement regional programs of water quality management, and to utilize charges (especially effluent charges) to finance the program. The legislative intent appears to have been:

that considerations of economic efficiency should be of prime importance in developing a national water quality program.

The river basin authorities created were comprehensive in scope--both as to enforcement authority and as to geographic area--with the ability to force upstream users to take corrective action for the benefit of those down stream. Since the act has taken some time to implement, there is extremely little actual experience to date. Consequently, although it is important to note another attempt to establish effluent charges, the French experience is not discussed further here.

Vermont Legislation¹

To date, the only known attempt in the U.S. to apply effluent charges to the problem of water pollution control has concerned the State of Vermont. Since effluent charges will not be utilized until July 1, 1971, it is not possible to include a discussion of Vermont's experience with the effluent charge approach set forth in the bill. However, the bill's provisions do indicate a clear intent to use effluent charges as an inducement to reduce water pollution since only firms which do not meet the state's standards are charged. Furthermore, these latter firms must agree upon a specific schedule of improvements at the end of which effluent standards will be met.

1. The Vermont legislation is not yet available in published form. Consequently, discussion is based upon, and quotations taken from, Vermont Senate Bill, S. 165.

The provision for effluent charges is contained in legislation with four main purposes: to provide for effective enforcement through increased penalties and a requirement for discharge permits, to provide flexibility in the classification of waters, to provide for provisional pollution permits, and to prevent further unregulated pollution.

The legislation requires reports to be filed with the Department of Water Resources specifying "the location, nature, volume and frequency" of any discharges of wastes into waters of the state if such discharges are expected to continue after July 1, 1971. After that date, no discharges may be made without a "discharge permit." Most firms will be able to obtain such a permit through application to the Department. But permits will be granted only if "the department finds that the proposed discharge will not reduce the quality of the receiving waters below the classification established for them. . ." according to the system of classification determined in the bill. These discharge permits would:

1. specify the manner, nature, volume and frequency of the discharge permitted;
2. require proper operation and maintenance of any pollution abatement facility necessary in the treatment or processing of the waste by qualified personnel in accordance with standards established by the board;
3. contain such additional conditions, requirements and restrictions as the department deems necessary to preserve and protect the quality of the receiving waters; and
4. be valid for the period of time specified therein.

Those unable to obtain discharge permits may not discharge unless they receive temporary permits from the board. This provision is of particular interest since the legislation would require the state Water Resources Board by January 1, 1971, to "fix and establish reasonable and just pollution charge rates for computing the amounts to be paid by temporary pollution permit holders. . ." These effluent charges, under the Vermont legislation, may also be revised by the board, as appropriate.

The stated purpose of the provision for effluent charges is worth noting in detail since it stresses the inducement effect of the effluent charges in limiting pollution. Moreover, the provision explicitly considers the damage that pollution causes other citizens, and attempts to relate the charge to such damages:

It is expressly recognized that the authorized discharge of certain wastes which will reduce the quality of receiving waters below the established classification represents an expropriation of a valuable public natural resource for private or limited use and that such discharges are permitted under this subchapter for economic reasons in the public interest of providing time during which the degrading effects of such discharges can be abated. The imposition of pollution charges shall have the principal purpose of providing the economic incentive for temporary pollution permit holders to reduce the volume and degrading quality of their discharges during the limited period when such discharges are authorized, thereby raising the quality of waters in the state. Such charges shall be for the further purpose of protecting the health, welfare and safety of the general public, protecting, preserving, and benefitting navigation upon the waters of the state and protecting the general public interest in such waters including recreational and aesthetic interest. The charges are not imposed for revenue purposes and any income received by the state under this section shall be

used solely for purposes of water quality management and pollution control.

. . .A pollution charge is the price to be paid per unit of waste discharged into waters of the state. The charge may vary among different types or classes of wastes to account for variations in the degrading effects of various wastes. The charges may also vary to account for variations in the water quality standards of different classes and the hydrologic conditions of different receiving waters.

In establishing the charges the board shall attempt to approximate in economic terms and damage done to other users of the waters, both private users and the general public, caused by the degrading effects of various types of wastes in varying volumes and frequencies of discharge upon water qualities of the different classes of waters. In determining relative degrading effect the board may employ any scientific or technical criteria or parameters such as biochemical oxygen demand and suspended solids and may express the unit charge in terms of such standards of measurement.¹

Temporary permits are given at the discretion of the water resources department to those who have been denied regular waste discharge permits. The factors to be considered by the department are the following:

1. the proposed discharge does not qualify for a discharge permit;
2. the applicant is constructing, installing or placing into operation or has submitted plans and reasonable schedules for the construction, installation or operation of an approved pollution abatement facility or alternate waste disposal system, or that the applicant has a waste for which no feasible and acceptable method of treatment or disposal is known or recognized but he is making a bona fide effort through research and other means to discover and implement such a method;

1. Vermont Senate Bill, S. 165. (Emphasis added.)

3. the applicant needs permission to pollute the waters of the state for a period of time after July 1, 1971, necessary to complete research, planning, construction, installation or the operation of an approved and acceptable pollution abatement facility or alternate waste disposal system;

4. there is no present, reasonable, alternative means of disposing of the waste other than by discharging it into the waters of the state;

5. the denial of a temporary pollution permit would work an extreme hardship upon the applicant;

6. the granting of a temporary pollution permit will result in some public benefit;

7. the discharge will not be unreasonably destructive to the quality of the receiving waters.¹

In conclusion, the Vermont legislation is of interest because it combines direct standard setting (polluters must meet specific standards in order to obtain waste permits) with a modified form of effluent or emission charge. Disadvantages with the charge in this temporary form are: that it must be tailored to individual circumstances; that it would be difficult to measure the charge's effect on limiting pollution; and that the charge itself might easily be too low, since the public would not reasonably be able to assess the charge's implications. Thus the firm with a large stake in the outcome might be able to negotiate a low charge. Nevertheless, the experiment could be a major innovation in water pollution control, and its outcome will certainly be influential in many public policy deliberations regarding pollution control. An important instance of these deliberations--the possibility of applying

1. Vermont Senate Bill, S. 165.

the effluent charge approach on a nationwide basis, as currently considered by the U.S. Senate--is discussed in detail in Appendix B.

Packaging Disposal Charges

While disposal charges for solid waste have been considered, less thought and discussion has been given to such a scheme than to effluent charges for the control of water pollution. In one form, however, disposal charges are very old. Many communities charge for garbage collection; indeed, collection is often undertaken by private firms. However, particularly in the larger cities, charges for garbage collection have come to be considered a tax, and a regressive one at that. For this reason, charges for garbage disposal have been on the wane, although commercial establishments are still often charged.

The Resource Recovery Act of 1970 follows a new tack.¹

The Act directs the Administrator of the Environmental Protection Agency to:

carry out an investigation and study to determine . . . the necessity and method of imposing disposal or other charges on packaging, containers, vehicles, and other manufactured goods, which charges would reflect the cost of final disposal, the value of recoverable components of the item, and any social costs associated with non-recycling or uncontrolled disposal of such items.

A bill reintroduced by Senator Nelson goes a step farther in recommending "national packaging disposal charges for all

1. P.L. 91-512. The Act is an amendment to the Solid Waste Disposal Act of 1965. (P.L. 89-272)

packaging manufactured or imported into the United States, which results, or may result, in solid waste or adverse environmental effects.¹ The bill would establish a schedule of charges by June 30, 1972, in order to:

Create economic incentives for the development of degradable packaging and the return, reuse, and recycling of packaging into the economy, to reduce the public costs of packaging and other solid waste disposal, to reduce the quantity of solid wastes, and to minimize the adverse effects upon public health, welfare, and environmental quality caused by the disposal of packaging.

The bill would utilize the funds for the construction of solid waste disposal and resource recovery facilities.

Bounty Payment for Automobile Hulks

In a related development, the Bureau of Solid Waste Management is considering an incentive plan involving a bounty payment for junk automobiles.² The initial purchaser of the automobile would be required to pay \$50 for a bounty registration which could be transferred from owner to owner until the car was scrapped. At that time the final owner would receive \$50 in addition to the scrap value of the automobile. Since the National Industrial Pollution Control Council recently reported that junk automobiles produce a high-grade scrap for recycling, the bounty may be sufficient to remove cars from the environment. The Council noted, on the other

1. U.S., Congress, Senate, A Bill to Amend the Solid Waste Disposal Act, S. 282, 92d Cong., 1st sess., 1971.

2. Ann Tasseff, "Solid Wastes Programs and Research," Environmental Reporter, Monograph No. 6, Vol. 1, No. 33 (1970), p. 23

hand, that new methods of compressing cars for transportation on flat-bed railroad cars were needed, and that the titling issue was still unresolved.

One advantage of the bounty plan as it stands is that cars are not usually scrapped for several years. The agency, therefore, has an opportunity to build up a sum of money and recover administrative costs from the interest received, or possibly some of the interest payments might be devoted to recovering cars already abandoned.

Emission Charges for the Control of Air Pollution

Serious interest in emission charges for controlling air pollution is relatively recent, at least compared with the effluent charge approach in water pollution control. Furthermore, emission charges for air pollution are probably more difficult to apply than charges for water, especially since central treatment facilities for air are not feasible. Thus, the money recovered from air pollution emission charges could not be put to a clearly defined control purpose. This is not an insurmountable problem--tariff revenues likewise go into general revenues--but it does remove the ready basis for charges.¹ Also, since there are a large number of sources to monitor, the administrative problems associated with air pollution emission charges are large.

1. To the extent that effluent charges for water pollution control have been advanced as a means to cover central treatment facilities, there would be no similar justification for emission charges for air pollution control.

Emission charges may still be worth initiating if they provide an incentive to control air pollution through either reduction or abatement at the source. The primary advantage of an emission charge system is that it encourages abatement at least cost. A low charge will have limited success; a high charge will reduce pollution considerably as many polluters discover it is cheaper to stop polluting than to continue paying the charge. Furthermore, emission charges can be adjusted upward or downward to achieve any given level of ambient air. With the rapidly emerging body of knowledge about pollution effects, this adaptability would appear to be an important advantage for the emission approach.

Given the paucity of experience with emission charges for the control of air pollution, there are only two examples of this approach to discuss here. First, the President has recently recommended a "Clean Air Emissions Charge" for sulfur oxides. The tax proposed is at a level which it is claimed will provide sufficient inducement to reduce sulfur oxides pollution substantially. Second, the single American experience involving air pollution emission charges occurred in Palm Beach Shores, Florida, where an ordinance set a "dumping fee" for air pollution. The Palm Beach Shores experience, however, was inconclusive since the ordinance was ruled invalid by the district court.

Sulfur Oxides Emissions Charges

The Nixon Administration proposed a "Clean Air Emission Charge on Sulfur Oxides Emissions" in his 1971 message to Congress

on the environment.¹ An accompanying document indicated that the primary concern of the Administration was that the charges approach would provide an incentive to develop new technology to remove sulfur from fuels or sulfur oxides from the emissions.² In other words, charges would provide an incentive to abate even more than that required by emission standards.

The Council on Environmental Quality and the Treasury Department have been detailed to work out specific legislation. Since this is still under consideration at time of publication, the legislation in final form cannot be outlined. However, the general thrust of the proposal is to levy a charge on sulfur emitted into the atmosphere from combustion or distillation of fossil fuels and from other possible sources. The revenue would be directed towards increasing programs to improve the quality of the environment, with special emphasis on the development of technology to reduce sulfur oxides emissions and programs to develop adequate clean energy supplies.

In many respects, the proposal is similar to the Vermont effluent charge legislation for water pollution control. A standard system is supplemented by a charge system to ensure against delay in reaching new and higher standards. The new sulfur oxides emissions charges would be directed toward achieving a new emission

1. February 8, 1971.

2. The Domestic Council, Executive Office of the President, The President's 1971 Environmental Program: Controlling Pollution (Book One). Washington, D.C.: Government Printing Office, 1971, pp. 8-9.

standard for sulfur oxides, issued by the Environmental Protection Agency in January, allowing no more than 365 mg/m^3 as a maximum 24-hour concentration not to be exceeded more than once a year after 1974. However, it is not clear (at least according to the public pronouncements of industry) that the technology or sufficient quantities of low-sulfur fuel exist to meet such a standard; emission charges may well provide a spur to the development of acceptable solution.

The discussions concerning legislative details primarily circle around consideration of who should pay the tax, and how. The Council on Environmental Quality and Treasury Department apparently favor a tax imposed upon the producers and importers of fossil fuels¹ although this would leave out smelters. It is felt that, in the main, the tax will be passed on to the users of the fuel.²

The incentive effect would work in two ways. The fuel producer would be encouraged to remove sulfur from the fuel he produces, or seek new supplies of low sulfur fuel, in order to reduce the tax paid to the Federal Government. The users would be encouraged to introduce technology to recapture sulfur oxides from their emissions. New technologies on the horizon, such as stack gas cleaning, tend to require very large operations if they are to be

1. E. W. Kenworthy, "Nixon Seeks Sulfur Tax as Antipollution Incentive," New York Times, February 2, 1971, p. 25.

2. Producers of high sulfur fuels might have to absorb some of the tax, as might their suppliers and, particularly, workers, but it is not clear that they would be penalized as severely as they would under a succession of laws requiring low sulfur fuels.

used effectively and economically; therefore, the rebate process would apply to a relatively small number of firms. But then, about two-thirds of sulfur oxides emissions in the United States are caused by fossil-fueled electric power plants, non-ferrous metal smelting plants, and petroleum refineries. Consequently, a small proportion of emitters might easily be responsible for most of the emissions.

This latter point has encouraged another possible means of collecting emissions charges. The Air Pollution Control Office has predicted that accurate metering devices for the detection of sulfur oxides emissions will be available within a year; consequently, some officials have proposed that these devices be used in assessing the charge upon all major emitters of sulfur oxides on the grounds that the millions of very small emitters left out produce a very minor portion of the total emissions.¹

1. The final mechanism is not as important as ensuring that (a) virtually all emitters of sulfur oxides are charged, and (b) rebates are available if sulfur oxides are removed from emissions by any means. Without these caveats, the charge system would be subject to a number of biases which would inhibit its effectiveness, perhaps seriously. The previous chapter considered one surrogate for an emission charge system--an emissions charge for power plants alone. A number of biases were noted; similar difficulties were indicated for a fuel tax.

The preference for a charge on all sulfur oxides emissions, rather than on a surrogate, is justified by the fact that it is the sulfur oxides in the air that are harmful, not those in the fuel. It is irrelevant from the environmental point of view whether the sulfur oxides are reduced by removing low-sulfur fuels or by removing sulfur from the smoke, or whether one firm, as opposed to another, abates. However, it is important, from the point of view of economic efficiency, that those which can abate at least cost do so first, regardless of the industry or the firm involved.

Another point of particular interest is the likelihood that the charge will be increased in stages: in 1972 the charge would be one cent a pound of sulfur content; two cents in 1973; three cents in 1974; four cents in 1975; and ten cents in 1976 and thereafter.¹ How these funds would be allocated has not been decided. The Office of Management and Budget is unlikely to look with favor on attempts to create an Environmental Trust Fund, or other attempts to block off revenues for special purposes. On the other hand, the Council on Environmental Quality and Treasury Department appear to feel the charge has a better chance of success if revenues are devoted to environmental and research issues. In that respect, the proposal would be to some extent an alternative means of raising funds for research into new sources of energy to the tax on electricity proposed by the Office on Science and Technology.

There are a number of possible implications in terms of other national goals and priorities which can be touched upon only briefly here. As the price of sulfur in recent years has drifted down from \$45 per ton toward \$30 per ton, the incentive effect of the tax (at \$20 increasing to \$200 per ton of sulfur recovered) would be significant for the recovery of sulfur both from fuels and from emissions. The importance of this effect can be illustrated with reference to Appalachia. Currently, a major coal-mining area,

1. E. W. Kenworthy, "Nixon Seeks Sulfur Tax as Antipollution Incentive," New York Times, February 2, 1971, p. 25.

but dependent primarily on high-sulfur coal, this region would suffer heavily from proposals to limit or tax the use of high-sulfur coal. But an emission charge on sulfur might have an advantageous effect for the region, insofar as desulfurizing high-sulfur coal proved financially feasible through tax rebates.

As well, at the levels of charge under consideration, the emissions charge on sulfur oxides should contribute substantially to the reduction of sulfur dioxide emissions, though it is likely to have a major effect on the price of sulfuric acid and sulfur since the proposal implies a subsidy of about \$100 a ton for sulfur removal from coal--compared to a price of about \$30 a ton for sulfur presently produced.

One potential disadvantage is that the proposal does not differentiate between different geographical areas. This would not matter if the damages due to sulfur dioxide increased in proportion with the concentration of sulfur dioxide in the air--or the pollutant covered an extremely broad area. But to the extent the damage is local and increases more than proportionately with concentration, it would be better to use regional charges--possibly time variable. This would have the effect of encouraging industry to move away from areas with high sulfur dioxide ambient air levels to those with low sulfur dioxide ambient air levels. As the latter may often be in locations with little industry, a variable tax could aid in regional redevelopment.

Palm Beach Shores

The community of Palm Beach Shores¹ has enacted an ordinance requiring the payment of emission charges for air pollution from stationary sources. The ordinance assesses as a dumping fee a penalty of \$20 per ton of pollutants. Those responsible for emissions are required to file a monthly report with the Town Building Inspector. The latter then computes and assesses the appropriate charge. The Town Building Inspector is granted the right to enter, during reasonable hours, any building, structure, or premise in the discharge of his official duties, in order to make any inspection or examination he may deem necessary for enforcing the ordinance.²

The ordinance was initially passed³ when a large motel installed an incinerator, and was upheld in county court. However, the motel appealed to the District Court, and the decision was reversed.⁴ As of this writing, the District Court ruling has not been appealed.

1. Palm Beach Shores, Florida, is a resort town about 75 miles north of Miami, with a population of 1,300 growing to about 5,000 in season. There is no industry; the town's economy is based upon a large number of hotels, motels and commercial establishments which cater to tourists.

2. Palm Beach Shores Ordinance No. 70.

3. September 21, 1964.

4. Information from Harry K. Jackson, Town Manager, October 28, 1970.

Emission Subsidies in Air Pollution Control

One form of emission subsidy might be a direct contracting approach in which the government specifies a package of pollution reduction (the kind and amount of different pollutants that must be curtailed) and then allows firms from the various industries to bid for the contract.¹ The firm offering the lowest cost bid to reduce its pollution according to the specified emission parameters would win the contract, and might reduce pollution in any way it chose to meet the contract specifications. In a case like this, the government would have to monitor only pollution output--before, during and after the contract--but would not need technical expertise to determine if the firm was using least-cost methods. Thus, the competition for the contract, plus the normal profit-maximizing notions of the firm, would be sufficient to assure a least-cost method of control without detailed supervision by government. Furthermore, detailed government supervision would not be needed because contracts for pollution control "packages"--a specified pollution reduction at a specified price--would be fixed cost contracts, rather than dependent upon a firm's actual costs.

1. This approach would differ from the direct contracting discussed in the previous chapter primarily to the extent that emission subsidies would be based upon emissions per se.

Permit Markets

An extension of the concept of emission charges has been suggested by Professor J. H. Dales.¹ If permits to pollute by given amounts per time period were introduced and required by law, then a market could be established allowing those with the lowest cost of pollution abatement to profit by installing equipment and selling their rights.

Professor Dales illustrates the theory with a discussion of lake pollution which is different from river pollution in that it principally affects lakeside communities themselves, rather than those further downstream. In this regard, lake pollution is similar to air pollution. Consequently, the market permit proposal may easily apply to the situation in air pollution. The argument may be summarized briefly as follows:

The early establishment of property rights in this country, and the increase in rents over the past three centuries has intensified the use of land and led to the invention of new technologies to maintain and improve its quality. Rents were not required for the use of water and little attention has been paid to maintaining the good quality of water resources. While it should, in theory, be possible to organize a rental system for the use of water similar to that established for land, water has certain characteristics that

1. J. H. Dales, "Land, Water, and Ownership," Canadian Journal of Economics, Vol. 6, No. 3 (1968). See also Professor Dales' book, Pollution, Property and Prices (Toronto: University of Toronto Press, 1968).

prevent such an arrangement in practice. Obviously, it cannot be divided into small independent units as can land. The Great Lakes drainage system is so vast that millions of people depend upon it for water supplies; yet it could only be divided into a small number of viable regions, and to allow some twenty or so private owners to control this enormous resource would be wholly unacceptable to democratic society. Consequently, the government must accept the responsibility of single ownership and decide on the uses to which the available water resources shall be put, how the division between amenity use and waste disposal shall be decided, and how it shall be maintained. These are decisions which in practice are political and not economic. "Once there is a political demand for 'pollution control', anti-pollution measures tend to be instituted incrementally until complaints about their cost outweigh complaints about pollution."

The government must decide how much pollution is to be allowed and it can then:

. . . enforce its decision in one of six main ways. It can regulate: (1) a waste quota can be assigned to each waste discharger and set so that the sum of the quotas does not exceed x; or (2) an across-the-board regulation that each discharger must reduce his waste discharge by [a given] percent may be promulgated. It can subsidize: (3) dischargers can be subsidized to reduce their wastes, either individually or (4) on an across-the-board basis of so much per ton of waste discharge reduced. It can charge: (5) an effluent charge can be levied on dischargers, either individually, or (6) on an across-the-board basis of so much per ton of waste discharged.

Professor Dales suggests that the administrative cost of any scheme to regulate polluters on an individual basis would be prohibitive. Across-the-board schemes have lower administrative costs and he believes that charging is preferable to subsidizing on the following grounds. First, some firms will manage to reduce their pollution for a smaller sum than the subsidy provided and therefore the subsidy will in effect contribute to excess profits. Second, subsidies provide no incentives to cut down the amount of waste generated in the first place--indeed they might have the opposite effect. A system of charges, on the other hand, will not result in excess profits; it will result in a change in the relative prices of goods which in turn "will result in a socially desirable adjustment of consumption patterns to reflect the differential costs of waste disposal as between different goods." Again, charges would provide incentives to reduce pollution emissions and adopt improved methods of treating waste before emission. Finally, in favor of a charging system, Professor Dales propounds a system of market permits.

The government's decision is, let us say, that for the next five years no more than x equivalent tons of waste per year are to be discharged into the waters of region A. Let it therefore issue x pollution rights and put them up for sale, simultaneously passing a law that everyone who discharges one equivalent ton of waste into the natural water system during a year must hold one pollution right throughout the year. Since x is less than the number of equivalent tons of waste being discharged at present, the rights will command a positive price--a price sufficient to result in a [given] percent reduction in waste discharge. The market in rights would be continuous. Firms that found

that their actual production was likely to be less than their initial estimate of production would have rights to sell, and those in the contrary situation would be in the market as buyers. Anyone should be able to buy rights: clean-water groups would be able to buy rights and not exercise them. A forward market in rights might be established. The rights should be for one year only, the price of one right for one year representing the annual rental value of the water for waste disposal purposes. (There is no reason, though, why speculators should not gamble in one year on the price of rights in later years.) The virtues of the market mechanism are that no person, or agency, has to set the price--it is set by the competition among buyers and sellers of rights--and that the price in the market automatically "allows for" the regional growth (or decline) factor. If the region experiences demographic or industrial growth the price of rights will automatically rise and induce existing dischargers to reduce their wastes in order to make room for the newcomers. The government should make it clear that it reserves the right to alter the allowable level of pollution (the number of rights it issues) at stated time intervals (say, every five or ten years). All that is required to make the market work is the inflexible resolve of the government not to change the rights issue during the interval, no matter what the political pressures to do so may be, and to enforce rigidly the requirement that a ton-year of waste discharge must be paid for the holding of one pollution right for one year. Pollution rights are fully transferable property rights, and any welching on the enforcement of the right would be a breach of trust.

Compliance with any point-by-point regulatory or subsidization scheme of pollution control establishes a sort of status-tenure property right. The right inheres to the discharger that earns it, and is only transferable (at the capitalized value of its implicit price) when the property to which it applies is sold. The market mechanism of the across-the-board charging scheme separates the property right to water use from the other assets of the discharger, and thereby makes the property right fully transferable. Full transferability and explicit prices are, as has been noted,

considered preferable to status tenure and implicit prices by contemporary populations in Western democratic societies.

One novel implication of the permit markets approach is that if attitudes towards pollution changed, either more pollution rights could be auctioned off by the government, or, as is more likely, the government could buy back pollution rights or permits and not use them. Similarly, conservation groups who preferred cleaner air would have the option of purchasing rights on their own account, and refusing to use them. This possibility would certainly reduce the problem of deciding whether such groups were interested enough in clean air to pay for it, or whether their case were merely an example of "special pleading."

Balanced against the advantages, however, are a number of possible shortcomings. First is the problem of monitoring. Merely introducing a system of rights or permits does not obviate the necessity of proving that a current permit holder is operating within the bounds of his permit. Nor is the concept readily extendable to the problem of inversions: during such periods even if rights existed they might have to be abrogated--and a system of rights regarding preferential abrogation would appear to be administratively difficult for all parties. The main problem, however, is in educating a sufficient portion of the public to accept such a proposal. Given the recency and novelty of the permit market proposal, the likelihood of this would seem slim indeed.

Summary and Conclusions

The major proposal for an economic incentive based on emissions per se is a system based on emission charges. As applied to air pollution, this approach would involve the establishment of a schedule of charges for emitting given amounts of particular pollutants into the air. Each polluter must then pay a certain charge to a pollution-control agency, according to how much and what kind of pollution he has emitted. The schedule of charges can be adjusted upward or downward to reach any desired level of ambient air, although to the extent possible, emission charges would be based on the amount of damages (or costs) associated with the pollution. There are obviously many difficulties in determining social costs of pollution.¹ It should be borne in mind, however, that emission charges will be set in the political arena and that, therefore, the relative strengths of various interest groups are going to be of great importance.² In this concluding section, the advantages and disadvantages of the emission charge approach are reviewed.

Economic Efficiency

Perhaps the primary advantage of emission charges for air pollution control is that they allow each polluter to control his

1. These difficulties stem from the imperfections in available information, or data shortages, or data gaps and the lack of agreement on many conceptual issues involved, particularly when synergistic effects occur. These problems, moreover, have multiplied when air pollution damages are considered not just with respect to human wealth but with respect to agriculture, materials, etc.

2. See Adrian J. B. Wood, J. Serge Taylor, Frederick R. Anderson, and Laurence I. Moss, "Strategies for Pollution Abatement" (unpublished Staff Study of the Committee on Public Engineering Policy, National Academy of Engineering, Washington, D.C., 1971), Chapter 3.

pollution in the most economical way, thereby encouraging establishment of the least-cost combination of overall controls.¹ The importance of this consideration has been stressed in a recent report of Government:

Waste controls to reduce adverse effects on the environment may be produced most efficiently by charging the waste discharger for the damages his actions impose on the community or for the cost the community must incur to offset the affects of his waste disposal. The community in this sense is the entire array of groups, entities, and persons affected by the waste disposer's actions.

The charges against the waste disposer must be determined either as a measure of actual damages caused or assigned against the discharger to produce a pre-determined degree of control or reduction reflecting an environmental quality standard. In either instance the level of the charge is the critical factor, and most difficult to determine. If the charge is too low, it will not constitute adequate inducement to reduce the wastes disposed

1. One authority on emission charges explains this as follows:

In theory, an effluent charge system would tend to accomplish automatically the least cost solution for any given level of air quality. Emitters will tend to reduce emissions till the additional cost of preventing a quantity of effluent from entering the atmosphere equals the per unit charge. Since assuming identical conditions the charge would be identical for all emitters, the marginal cost of preventing a ton of effluent from escaping into the atmosphere--equal to the charge--would likewise be identical among emitters. Since it would therefore be impossible to decrease the social cost of achieving a given level of air quality under specified technology by shifting resources engaged in air pollution control from one emitter to another, the selected air quality would be achieved at minimum social cost.

Anthony B. Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources" (unpublished Ph.D. dissertation, Columbia University, 1970).

and if the price is too high it will induce more control than is necessary and will be uneconomic in effect. Experience through the use of such fees will help reduce this uncertainty. Experimentation could be fruitfully pursued in a few river basins now.¹

Effectiveness

Another advantage of emission charges for air pollution control would appear to be its potential effectiveness.² If experience with effluent charges for water pollution control is any indication, firms react to the charges by reducing their effluent and/or increasing treatment of their wastes.³ Furthermore, if firms do not respond to appropriate emission charges, it is not at all certain they would respond to direct regulation. If firms do not respond, the implication is that the costs of control are extremely high and

1. Federal Coordinating Committee on the Economic Impact of Pollution Abatement, Summary Report of the Working Committee on Economic Incentives (Revised). "Cost Sharing with Industry?" Washington, D.C., 1967, pp. 34-35. (Mimeographed.)

2. A recent study of emission charges has concluded that for electric power plants, at least, the effect of a tax of \$50 per ton would be to very substantially reduce pollution. Indeed, the results cast doubt on present legislation which forces the industry to rely on low sulfur fuel; an emission charge would prompt more efficient methods of air pollution abatement within relatively few years. Adrian J. B. Wood, J. Serge Taylor, Frederick R. Anderson, and Laurence I. Moss, "Strategies for Pollution Abatement" (unpublished Staff Study of the Committee on Public Engineering Policy, National Academy of Engineering, Washington, D.C., 1971), Chapter 6.

3. Examples of the inducement effect have been cited above and may be found in much of the literature. See, for example, Allen V. Kneese and Blair T. Bower, Managing Water Quality: Economics, Technology and Institutions (Baltimore, Md.: The Johns Hopkins Press for Resources for the Future, 1969), p. 252; and U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2d sess., p. 188 ff.

hence the firm is unwilling to change. Merely setting emission standards will not decrease this very high cost. In cases like this, the only solution may be land use controls whereby firms may continue to pollute only if they are located at a considerable distance from population centers. This solution, of course, would apply more easily to new firms, who would have to bear only more transportation costs, than old firms, which would have the expense of relocation.

Adaptability

Emission charges are, potentially at least, more adaptable than many other policies for air pollution control. While ambient air standards may be fairly similar for different regions, the number of polluters will vary considerably from region to region and control requirements will vary accordingly. This situation can be covered by having different emission charge schedules in different areas depending on the seriousness of the prevalent air pollution. Indeed, if the charges are set in an essentially political manner, various interest groups may have an opportunity to exert influence and thus affect actual air quality. It is difficult to say, a priori, which groups should receive most favorable treatment. Conservationists will mount a fervent argument supporting the right of future generations to be spared from irreversible changes; industry will describe the jobs that will be lost because of the charges. Different areas may well have different priorities. Economically depressed areas may well have a particular need to attract industry despite severe existing pollution. Moreover, if the economic

climate should change, decisions regarding air pollution control could be modified by changing the level of the emission charge.¹

Another area of potential advantage of emission charges lies in the solution to emergency problems. During the recent inversion spreading over most of the Eastern seaboard, no emergency regulations regarding air pollution were utilized. While states such as New Jersey have now set up emergency plans, their effectiveness has not yet been proved. It might be possible to increase emission charges rapidly, at least for major polluters, when ambient air conditions start to deteriorate. This would influence, for example, electric power companies to switch from coal or oil to

1. This view is disputed in one study:

If a pollution charge is regional. . .there will be an incentive for industry to move to the region with the lower charge. . .if. . .it is uniform over the entire country, the location effects are eliminated, but the pollution reduction outcomes are different for different regions. In short, there is a direct tradeoff between the location effects of an emission charge and the uniformity of environmental quality achieved. . .

Whatever other justifications for preferring a national to a regional charge system are put forward, the overriding reason will be avoiding the political costs of a regional system. Indeed the objections to such a solution may already have been rendered politically irrelevant in light of the Congress' support for national emission standards for new plants, a measure designed to cancel out just such location effects.

Adrian J. B. Wood, J. Serge Taylor, Frederick R. Anderson, and Laurence I. Moss, "Strategies for Pollution Abatement" (unpublished Staff Study of the Committee on Public Engineering Policy, National Academy of Engineering, Washington, D.C., 1971), pp. 3-16, 3-17.

natural gas during inversions merely because the suddenly high charge associated with sulfur dioxide could be avoided by the switch.

Research and Innovation

Emission charges have been compared to user charges by several writers. Indeed, as an earlier section noted, a steel executive unconsciously implied this relationship by referring to his "use" of air. Industry is accustomed to paying for labor, equipment, land and most supplies, but is not yet ready to pay for the "use" of air. Consequently, little effort has been made to find new ways of conserving it (i.e., devising new ways of abating pollution).

This is not the case for those supplies for which industry is accustomed to pay. Research and development funds are continually devoted to find "labor saving" innovations, in hopes that the total wage bill can be cut. Similarly, efforts to reduce the use of capital, supplies, management expertise, etc., are widespread. The difference between supplies and air is that there is no profit to be made in devising new means of abating air pollution.

Emission charges would provide this incentive. Provided a firm could be assured that by installing appropriate devices it could reduce emission charges, there would be a ready market for innovations in air pollution control. No government intervention would be called for and interest would be widespread among firms subject to emission charges and also, of course, among other firms having a potential to develop and supply control equipment.

Low-Beer puts the matter concisely:

If the use of air resources for waste disposal is given a direct and explicit cost, profit maximizing business firms will minimize these costs as a matter of Darwinian Survival.¹

"License to Pollute"

Emission (or effluent) charges have been criticized by some as constituting a "license to pollute." Although the specific charge implied by this phrase is not always clear, it runs throughout the Senate testimony of 1966 and 1970, as discussed above. From this testimony, however, it would appear that "license to pollute" is an emotive phrase which has been used to obscure other considerations, since the same objection could be made to any approach to air pollution control. Otherwise stated, any approach short of total prohibition has the effect of allowing some pollution to occur. To the extent that some pollution is permitted, all approaches constitute a "license to pollute." Thus, for example, if firms ignored fines set at a low level under the direct regulation approach, this, too, would be a "license to pollute." The real question, therefore, is not whether pollution is permitted, but how much pollution is allowed to occur.

1. Anthony B. Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources" (unpublished Ph.D. dissertation, Columbia University, 1970), p. 104. The conclusion follows a complete analysis given in pp. 97-104. It is worth noting, however, that profit-maximization is not a necessary prerequisite for the success of firms; as outlined in Chapter 7, certain firms which do not maximize profits are still affected if they merely attempt to minimize costs.

Ambient Air Standards

The establishment of ambient air standards is a crucial step in any governmental approach to air pollution control. In any approach, it has been pointed out, "Standards not only state the goals of the program, they also provide a measuring stick to determine the program's progress and a basis for determining what actions should be taken by the program."¹ The ambient air standards for an emission charge approach would probably be based upon the same considerations (e.g., air which will not produce disease in healthy members of the population) which are used in other approaches to air pollution control. Given these standards, the schedule of emission charges can be adjusted upward or downward to reach any desired level of ambient air. A low emission charge will result in a high level of pollution. However, as the charge is raised, more firms will find it to their advantage to reduce pollution.

Schedule of Emission Charges

Once ambient air standards are set, however, questions have been raised as to whether the schedule of emission charges would be set high enough to result in the desired quality of air. The political problems which could occur have been suggested in connection with effluent fees for water pollution control:

While the public might approve of the general idea of an effluent fee system, the actual setting of the fees is the kind of technical decision which

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 153.

it finds difficult to follow or understand. Industry groups, on the other hand, would understand the fees (since they would have to pay) and would follow such decisions closely. There is thus the risk that the public would be apathetic and would permit the fees to be set at too low a level to achieve the desired water quality. Effluent fees would not be imposed in a political vacuum, and the pressures exerted by industries and some public officials for lenient pollution controls would still be present.¹

In the absence of actual experience with emission charges, of course, an accurate assessment of such an approach must be somewhat speculative. It is not entirely evident, however, why emission charges would be more difficult for the public to follow and understand than the present emission standards. Indeed, it is conceivable that emission charges (e.g., \$45 per ton of sulfur oxides emitted) would be more comprehensible to the average citizen than would be the existing emission standards (e.g., no power plant can discharge emissions containing more than a specified number of mg/m³ of sulfur oxides for every Y hours).

Even more difficult for the public would be a comparison of standards from one jurisdiction to another. As one author² has

1. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 179. Davies advances two examples to lend indirect empirical evidence to his fear that political forces would undermine the effectiveness of an effluent fee system: the Ruhr Valley effluent fee system in Germany and the practice of setting sewer rental charges in many American communities.

2. Bruce C. Netschert, "Economic Trade-Offs in Air Pollution Abatement" (Paper for presentation at the Annual Meeting of the American Physical Society, New York, February 4, 1969), p. 15. The standards cited are for ambient air, but the same problems of confusion and non-comparability would hold for emission standards.

pointed out, there is a wide variation in the levels, durations and frequencies prescribed:

I believe it is important to recognize that the choice of criteria itself involves trade-offs which, although they may not be strictly economic, have economic implications. The criteria I have in mind are the ambient air standards which are the goal of the regulation and the maximum level of emissions permitted. Compare, for example, the ambient air SO₂ concentration criteria in the following jurisdictions (all concentrations are by volume):

St. Louis Metropolitan Area:	0.25 ppm for 5 minutes, once in any 8 hours 0.10 ppm for 1 hour, once in any 4 days 0.05 ppm for over 24 hours, once in any 90 days
San Francisco Bay Area:	1.5 ppm for 3 minutes during the daytime, 6 minutes during 24 hours * * (14 intermediate cate- * gories, by 0.1 ppm * steps) * 0.3 ppm for 8 hours during the daytime, 16 hours during 24 hours
State of Colorado:	0.5 ppm for one hour 0.1 ppm for 24 hours

There is, as can be seen, a wide variation in levels, duration and frequency in the various criteria, which is not surprising, since one would expect that the criteria would differ for different areas, each of which has its peculiar circumstances. The significance of the figures in the present context is their indication of the almost infinite number of combinations of level, duration, and frequency that is possible, and each combination has its own trade-off, or cost-benefit relationship. I have no idea how any of the listed criteria were arrived at, but I suspect not much consideration was given to the trade-off aspects

of the choice. To the extent this is true our air pollution regulators may not only be making implicit or unrecognized trade-offs on the wrong terms, the trade-offs may be the wrong ones. The possibility becomes stronger, moreover, when the choice of criteria is widened to include not only ambient air levels but emission levels (without relating them to ambient air levels) and limitations on the sulfur content of fuels.

From the standpoint of the public, the significance of these figures is that they provide a confusing number of possible combinations of level, duration and frequency. Hence, there is no easy way for the public to comprehend and compare standards as they vary from jurisdiction to jurisdiction. In contrast, putting a price on pollution in the form of an emission charge would seem more straightforward and easily understandable.

Absence of Centralized Air Treatment

As noted very early in this chapter, not all aspects of effluent charges for water pollution control are relevant to controlling air pollution. Much of the literature and public discussion, for example, has emphasized that large scale, centralized water treatment facilities are frequently cheaper than treatment facilities at each individual plant. This aspect, however, is irrelevant for air pollution control since air, unlike water and solid waste, cannot be centrally treated. Hence, air pollution control must be on a source-by-source basis rather than through centralized treatment facilities.

The impossibility of centrally treating air pollution, however, raises a question with respect to the employment of emission

charge revenues. The money collected from effluent charges for water pollution control is usually used to provide centralized pollution control facilities.¹ In the absence of such facilities for treating air, the money collected from emission charges could be used for research and development of control techniques, air quality monitoring and other activities of the pollution control agency. But in the absence of centralized air treatment, a large part of the emission charges collected would have to be utilized for other purposes, perhaps most appropriately for general government revenues.

Monitoring

Emission charge approaches are often criticized as requiring extensive monitoring, most of which is not yet available. However, National Air Pollution Control Administration reports indicate that appropriate equipment for SO₂, among other pollutants, will be available in the near future. But even for the pollutants for which no reliable monitoring is available, the emission charge approach may be at no more of a disadvantage than other comparable approaches. Emission standards, for example, cannot be enforced without suitable monitoring equipment.

The monitoring requirements for emission charges have been considered in some detail by one of the leading advocates of this approach:

1. See discussion on the Ruhr Valley Genossenschaften, pp. 8-15--8-22.

No one should pretend that the administration of an effective air pollution control scheme will be simple or cheap. Measurement and monitoring of discharges are necessary under any control scheme and can be expensive and technically difficult. Likewise, whatever the control scheme, finding the optimum degree of abatement requires the calculation of benefits and costs; these calculations are conceptually difficult and demanding.

The point that needs to be emphasized strongly is that the cost of administering a control scheme based on effluent fees will be less than the cost of administering any other scheme of equal effectiveness. An effluent-fee system, like ordinary price systems, is largely self-administering.

This point is important and is worth stating in detail. First, consider an effluent-fee system. Suppose a schedule of fees has been set. Then firms will gradually learn the rate of effluent discharge that is most profitable. Meanwhile, the enforcement agency will need to sample the firm's effluent to insure that the firm is paying the fee for the amount actually discharged. However, once the firm has found the most profitable rate of effluent discharge, and this is known to the enforcing agency, the firm will have no incentive to discharge any amount of effluent other than the one for which it is paying. At this point the system becomes self-administering and the enforcement agency need only collect bills. Second, consider a regulatory scheme under which the permissible discharge is set at the level that actually resulted under the effluent-fee scheme. Then the firm has a continuing incentive because of its advantage on the cost side to exceed the permissible discharge rate so as to increase production. Monitoring by the enforcement agency therefore continues to be necessary.

Of course, under either a regulatory or an effluent-fee scheme, a change in conditions will require the search for a new "equilibrium." Neither system can be self-enforcing until the new equilibrium has been found. The point is that the effluent-

fee system becomes self-enforcing at that point,¹
 whereas the regulatory system does not.

Who Will Be First?

Perhaps this section can be concluded best with the following comment by a leading authority on pollution control:

With all these advantages, why hasn't the effluent-fee system been applied in the United States? At the present time it is probably not feasible to apply it to the control of air pollution. The sources of air pollution are so numerous and reliable monitoring instruments so expensive that the key step of monitoring all individual effluents is not possible, given current technology. To apply the system to water pollution control it is necessary to have a control commission which encompasses an entire river basin and which has sufficient authority to impose fees. In the United States the Delaware River Basin Commission and the Tennessee Valley Authority are the only bodies which come close to having the requisite authority, and they do not currently have such authority. There is also the question of which river basin should go first in trying the system. Because of the experimental nature of the approach, neither the Federal Government nor anyone else would encourage instituting the system in all river basins at once. And yet since the consequences of the system are not fully known, and the degree of compliance to pollution standards would hopefully be higher than it is at present, industries in any basin would oppose the system and officials in the affected states would be reluctant to pioneer it because of possible adverse effects on economic development. Thus, even if there were many river basin commissions equipped with the legal and political power to impose an effluent-fee system, none of them would be eager to be the first to apply it.²

1. Edwin S. Mills, "Economic Incentives in Air-Pollution Control" in The Economics of Air Pollution, ed. by Harold Wolozin (New York: Norton, 1966), pp. 47-48. The problems of monitoring and surveillance for effluent charges and for other approaches to air pollution control will be discussed in detail in a future report.

2. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 178.

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CHAPTER 9

NEW SOUTH WALES SYSTEM¹

Perhaps the most interesting approach to air pollution control outside the United States is in the Australian state of New South Wales.² The New South Wales system, which has been in operation since the early 1960's, has several aspects worthy of detailed consideration.

1. The New South Wales system is based upon emission and performance standards which are similar to the emission and performance standard provisions in the American Clean Air Act Amendments of 1970;
2. Air pollution control in New South Wales is financed in large measure through revenues derived from the licensing of major polluters. The licenses, annually costing from \$10 to \$1000 per year, are considered licenses to operate within established emission standards, not licenses to pollute;
3. Substantial support for the emission standards and licensing approach has come from New South Wales private industry. Several firms, in fact, have actually requested that they be licensed in the system so as to avail themselves of government technical assistance;
4. Government has the authority in New South Wales to specify the use by private industry of certain control equipment, fuel types, and stack heights; and

1. The authors wish to express their appreciation to Professor John L. Sullivan of the Department of Civil Engineering, Syracuse University, past Principal Engineer, Air Pollution Control Branch of the Department of Health, Australia, and to Mr. R. P. Murphy, the present Principal Engineer, for their help in reviewing the draft version of this chapter and for the improvements they suggested which have since been incorporated.

2. This statement is based upon a review of work in progress in many countries. A selection of the literature consulted (approximately 125 works) is listed in the Annotated Bibliography, Section 9, "Foreign Air Pollution Control Programs".

5. Government has the authority in New South Wales to ensure that new industrial facilities minimize air pollution and to prevent the construction of new plants if they are likely to have a particularly adverse effect on air quality. These powers are in some respects similar to the standards of Performance for New Stationary Sources in the new American legislation.

Given these interesting aspects of the New South Wales system, this chapter discusses the setting and historical development of the system, its basis in the British Alkali Acts, and the enforcement machinery set forth in the New South Wales Clean Air Act of 1961. The chapter concludes with a summary of the system and a discussion of its possible relevance to air pollution control in the United States.

Setting and History

New South Wales is the most populous and heavily industrialized state in Australia. It contains about 40 percent of the nation's population and is also the major center of heavy industrial production, mining most of the nation's coal and manufacturing virtually all of the steel produced in Australia. Air pollution problems in New South Wales are found primarily in three coastal cities: Sydney, the capital, with a population of 2,750,000, and Newcastle and Wollongong, both of which have about 200,000 inhabitants. With regard to climatology and topography, there are

analogies between the east coast of New South Wales and the coast of Southern California.¹

Government involvement in air pollution control in New South Wales dates back at least to 1902, with the passage of the Smoke Nuisance Abatement Act in that year. Although the appearance of this act antedated most similar legislation elsewhere in the world,² no action appears to have been taken under it. Writing in 1965, the Principal Engineer of the New South Wales Department of Public Health concluded that "since no record of any proceedings having been taken under the Act can be found," the legislation "had little or no effect on preventing air pollution, even by smoke."³

It was not until the post-World War II period, and particularly after the London disaster of 1952, that real attention was given to air pollution in Australia. With the publication in

1. In point of fact, of course, there are a variety of atmospheric areas along the southern California coast. For further discussion of similarities between these areas and New South Wales, see J. L. Sullivan, "Sydney, Potential Los Angeles of the Southern Hemisphere," Journal of Air Pollution Control Association, Vol. 12 (1962), p. 474.

2. By way of comparison, only four American cities had similar ordinances in 1902: Chicago (adopted in 1881), Cincinnati (1881), Brooklyn, (1895), and New York City (1898). See L. W. Pollack, "Legal Boundaries of Air Pollution Control--State and Local Legislative Purpose and Techniques," Law and Contemporary Problems, Vol. 33 (1968), p. 331, and Kennedy and Porter, Vanderbilt Law Review, Vol. 8 (1955), p. 854.

3. J. L. Sullivan, "Australia Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 429.

1954 of a report by the Committee on Air Pollution¹ in Great Britain, a similar committee was established by the New South Wales State Parliament in 1955. The committee, composed of representatives from government, universities, and industry, took almost three years to study the state's air pollution problem, and in particular the records of the monitoring program which has been started by the New South Wales Department of Public Health in 1953.

After this lengthy examination the committee concluded that New South Wales did have a significant air pollution problem, and that new legislation was necessary. The committee report,² presented to the State Parliament in 1958, made the following principal recommendations:

1. That the work of monitoring air pollution be continued and expanded;
2. That legislation be enacted to provide new administrative machinery to abate air pollution;
3. That a state agency be established to continue the monitoring of air pollution, to supervise processes likely to give rise to special problems, and to give expert advice to industries and local government councils on air pollution control; and
4. That the cost of establishing and administering the proposed state agency be borne substantially by revenues received through the registration of pollution-producing industries.³

1. Great Britain, Parliament, Report of Committee on Air Pollution, Cmd. 9322 (HMSO, 1954).

2. Committee on Air Pollution in New South Wales, Parliamentary Report No. 96 (New South Wales Government Printer: 1957-58).

3. The foregoing has been paraphrased from the summary of J. L. Sullivan in "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 429.

The committee's recommendations were quickly approved by the New South Wales government and a bill was submitted to the State Parliament in 1960. However, since the government was anxious that the legislation be generally acceptable, particularly to industry, the proposed act was not adopted immediately but was allowed to remain open for public comment until the following year. Some relatively minor modifications resulted, but in 1961 the New South Wales Clean Air Act became law without any change in basic principles.¹

Basis In British Alkali Act

The development of New South Wales legislation was, no doubt, influenced by the introduction of the Clean Air Act in Britain in 1956. However, although some provisions from the latter legislation were incorporated into the New South Wales Clean Air Act, it was not used as a model. Instead, the New South Wales legislation was based very much upon the older British Alkali and Works, Etc. Act of 1906, which in turn was developed from the original Alkali Act of 1863.² The control of air pollution from

1. Clean Air Act, 1961, 69 Elizabeth II (New South Wales, Australia).

2. 26 and 27 Victoria (1863) c. 124. The major difference between the New South Wales approach and that under the Alkali Acts is in what is regulated. The British Alkali Acts regulate specific industrial processes, rather than the entire premise, as under the New South Wales system. Consequently, in England, an inspector for nitric acid processes would ignore an unlawful incinerator since the incinerator would be the concern of another inspector. In New South Wales, there is only one inspector for all emissions from a particular plant location. Information from J. L. Sullivan, former Principal Engineer, Air Pollution Control Branch, October 21, 1970.

British industries is considered by some authorities to be the most stringent industrial control in actual operation in the world.¹

Prior to 1863, British alkali works were poisoning the air with massive discharges of hydrogen chloride from the Leblanc process for the manufacture of sodium carbonate. Under pressure from nearby residents, the managers of the works experimented with water scrubbing to absorb the hydrogen chloride, but with little success. The Alkali Act of 1863 required a 90 percent reduction in hydrogen chloride emissions, and was passed by Parliament despite expert testimony to the technological difficulties in achieving the required reduction.²

1. A. A. Mister, "Britain's Clean Air Acts," University of Toronto Law Journal, Vol. 20 (1970), p. 268.

2. A professor of chemical engineering at the City College of the City University of New York has suggested recently that the "technological response" to the 1863 act may provide a suggestive historical parallel to present-day problems with the technology for air pollution control.

Soon (after passage of the Alkali Act of 1863) sophisticated gas-scrubbing towers appeared, exceeding the act's requirements. For a while much of the hydrochloric acid produced by the towers was taken to sea and dumped, but profitable markets for the acid developed. Most significantly, perhaps, the Alkali Act appears to have stimulated invention. Chlorine gas was a curiosity before Weldon and Deacon files their patents (in 1866 and 1868, respectively) disclosing chlorine processes which soon turned HCL gas formerly wasted into profits.

See, Arthur M. Squires, "Clean Power from Coal," Science, Vol. 169 (1970), p. 821. The purpose of the article, according to Squires, is twofold: first, "to persuade that paths of technological development exist that could lead to suppression of SO₂ from coal and at the same time to a lower cost of power;" and second, "to argue that a massive injection of money into coal engineering is the immediate ingredient necessary to open up those paths of development."

With passage of the 1863 legislation and the subsequent British Alkali and Works Act of 1906, all significant industrial plants, as well as most major fuel consumers, are required to register with the government and to be subject to a series of routine inspections. Actual pollution control is achieved through the establishment of emission standards for certain compounds and materials. The approach embodied in their early legislation continues to be applied in Great Britain today on a national basis.

New South Wales Clean Air Act

Under the New South Wales Clean Air Act,¹ the approach of the British in the Alkali Acts was incorporated and extended. The enactment of the New South Wales Clean Air Act in 1961 replaced all previous legislation relating to stationary sources of air pollution.² The main provisions of the Clean Air Act can be summarized as follows:

1. Air pollution control is based on emission standards;³

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1. Clean Air Act, 1961, 69 Elizabeth II (New South Wales, Australia).
 2. The 1961 Act, however, does not apply to mobile sources of air pollution. Two of the most important of these, automobiles and ships, fall under the respective jurisdictions of the Motor Traffic and Maritime Services Acts, and are subject to administration by the appropriate departments.
 3. Ibid., Section 15.

2. Two types of standards are established: specific standards prohibiting emissions of a substance above a specified rate¹ and a general standard requiring use of such practical means necessary to minimize air pollution;²
3. Control is aimed at industries that have significant air pollution potential (major sources);³
4. Future major sources must be approved as to their site and their plans and specifications before construction can begin;⁴
5. Existing major sources are required to obtain an annual license permitting operation within the standards.⁵ A fee is charged for the license and the funds provide financial support for the agency;⁶ and
6. Control of minor air pollution sources is largely left in the hands of local government.

Licensing of "Scheduled Premises"

The initial step in the New South Wales system is the decision as to which industries have significant potential for air pollution. Industries of significant potential, called

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1. Ibid., Sections 15(1) and 19(1).
 2. Ibid., Sections 15(2) and 19(2).
 3. Clean Air Act, as amended, 1964, Section 5.
 4. Clean Air Act, 1961, Section 16.
 5. Ibid., 1961, Section 11.
 6. Ibid., Section 13.

"Scheduled Premises," must obtain a license to operate.¹ The main purpose of the licensing, according to one authority "is to simplify contact" between government and industry. "The licensing system," he adds, "also provides the means of financially supporting" the (state-wide) control organization . . ."² The same source states that, in 1965, there were approximately 750 "scheduled premises" licensed in the state of New South Wales;³ these industries paid fees ranging from \$10 to \$1000 per year. Fees are collected by the Air Pollution Control Branch of the New South Wales Department of Public Health. The same agency grants licenses which are renewable on an annual basis.

In the Act, three major categories of scheduled premises have been established. These include: one, any premises being used for cement, ceramic, chemicals, coke, ferrous or non-ferrous metal, gas, grinding and milling, oil refining, primary metallurgical

1. An important exception is contained in Section 9. The Governor of New South Wales must proclaim those geographic areas for which a license will be required. If an area is not proclaimed then no license is required, although the emission standards, as appropriate, are still applicable. The purpose of this provision was to avoid requiring government licensing and inspection of remote industrial facilities. Information from J. L. Sullivan, October 21, 1970.

2. J. L. Sullivan, "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 429. The license fees pay about half of the agency's budget; the rest being made up by New South Wales government appropriations. Information from J. L. Sullivan, former Principal Engineer of the Air Pollution Control Branch, October 21, 1970.

3. Letter from R. P. Murphy, Principal Engineer, Air Pollution Control Branch, March 10, 1971.

processes for scrap metal recovery, or pre-mix bitumen works; two, any premises containing any boiler incinerator or furnace consuming more than one ton of combustible material per hour; and three, any premise on which any fuel-burning equipment or industrial plant is operated by the Commissioner for Railways or the Commissioner for Government Transport.¹

Establishment of Emission Standards

The next step consists of establishing emission standards. Emission standards may be either specific or general. General emission standards are discussed in the following section, while this section discusses specific standards which prescribe the maximum permissible concentration or rate of emission.² It is important to note that the New South Wales standards limit the rate at which pollutants can be emitted but not the total quantity.³

Under a procedure frequently adopted in Australia, the Act itself does not contain actual emission standards, but provides the authority by which they are prescribed. This procedure simplifies administration of the law, it has been argued, since "regulations can be altered, added to, or deleted without the necessity of fitting them into a busy Parliamentary session. However, no regulation can become law unless it is ratified by

1. Clean Air Act, 1961, Section 5 (as amended, 1969).

2. Ibid., Sections 15(1) and 19(1).

3. R. P. Murphy, "Advances in Air Pollution Control in Australia," Australian Chemical Processing and Engineering (November, 1967), pp. 16-23.

having been tabled for 14 days in the State Parliament during a session."¹ Based on the economic feasibility of current air pollution control technology, an Air Pollution Advisory Committee recommends whether standards should be set and at what level.

Recommendations often are based on technical advice received from the Air Pollution Control Branch. There has been little recent change in the standards, although consideration has been given to some additional standards.²

The emission standards set forth according to the latest available data are summarized in Table 9-1. Most standards are expressed in grains per cubic foot, the latter being defined as that volume of dry gas at 32°F and atmospheric pressure.

Given the large number of possible air pollutants, it is obvious that relatively few are covered by existing New South Wales emission standards.³

1. J. L. Sullivan, Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 431.

2. There were slight changes in the regulations in 1966, 1967, and 1969, but not recent addition or change in the standards.

3. Whereas standards for 13 pollutants are set forth in the 1965 regulations, some 30 pollutants have been identified as important by the U.S. Federal Government as of early 1971.

Table 9-1

LIMITS OF EMISSION OF AIR IMPURITIES IN THE REGULATIONS
UNDER THE NEW SOUTH WALES CLEAN AIR ACT¹

Contaminant	Limit	Remarks
Solid particles	0.2 grain/cubic foot	Metallurgical furnaces required to meet 0.1 grain/cubic foot
Smoke	Ringelmann 2	Limited exemptions allowed for lighting up from cold and soot-blowing
Sulfuric acid mist or sulfur tri-oxide	0.1 grain/cubic foot	Expressed as SO ₃
Sulfur dioxide from sulfuric acid manufactures	3 grains/cubic foot	Expressed as SO ₃ . Plants recovering SO ₂ from metallurgical processes are allowed 4 grains/cubic foot
Fluorine, hydro-fluoric acid or inorganic fluo-rides	0.05 grain/cubic foot	Expressed as HF
Chlorine	0.1 grain/cubic foot	Expressed as Cl ₂
Hydrogen sulfide	5 parts per mil-lion	Expressed as H ₂ S
Nitrogen dioxide	1 grain/cubic foot	Expressed as NO ₂ . Nitric acid plants allowed 2 grains/cubic foot
Lead, arsenic, antimony, cadmium, mercury	0.01 grain/cubic	Expressed as the element in each case

1. From J. L. Sullivan, "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 431.

Best "Practicable Means"

The second aspect of emission standards in New South Wales is the general standard "best practicable means."¹ Where standards for particular pollutants have not been set forth in regulations, emitters to the air are required to use the "best practicable means" of controlling pollution. What constitutes "best practicable means" is usually decided by negotiations between government and the company concerned.²

A government participant in these negotiations has pointed out some of the considerations that come into play in interpreting the law:

1. While "best practicable means" is not the statutory definition, it effectively summarizes the actual standard. According to Dr. John L. Sullivan, former Principal Engineer of the Air Pollution Control Branch, in a conversation on October 21, 1970, the administratively used general standard is "best practicable means." Sections 15(2) and 19(2) of the Clean Air Act, for scheduled and unscheduled premises respectively, require that:

Where any such standard has not been so prescribed the occupier of any scheduled premises shall conduct any trade, industry or process, or operate any fuel burning equipment or industrial plant, in or on such premises by such practicable means as may be necessary to prevent or minimize air pollution.

2. J. L. Sullivan, "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 431. The "best practicable means" standard now in use in New South Wales was adopted substantially from the provisions of the Alkali Act and practice under it in Britain.

Although it is not stated in the legislation, the term "practicable" is taken as including economic considerations. Thus, there are some cases where something less than the best theoretical technological method might be accepted.¹

Enforcement or Exemption

Once scheduled premises have been licensed and emission standards set, the extent of enforcement depends upon the approach adopted by the administering agency. Perhaps the approach generally taken in New South Wales can be suggested best by the following analysis of early experience by the Principal Engineer of the Air Pollution Control Branch of the state's Department of Public Health:

The first set of emission standards took effect from January 1, 1965, but as they were only published in February 1964, it was impossible in the time (available) for most factories to install control equipment to comply with the limits. This had been foreseen and was provided for in the Act by giving the minister power to grant exemptions in any case or for any period he might determine. This approach was considered preferable to the alternative of allowing a period of sufficient length for all sources to be controlled. Thus, many of the minor problems have already been removed and in the more complicated installations the department has been able to ensure that definite action has been initiated. Firms that cannot assume exemption will be granted (automatically) and if (an exemption is) needed formal application must be made. Each case is

1. J. L. Sullivan, "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 431. These same considerations, Sullivan adds, apply even where standards have been set. "In those cases where the limits are (subsequently) relaxed. . .the regulations specify that the "best practicable means" of preventing air pollution are to be employed."

investigated and if exemption is justified it is given for the necessary time. Periods from a few months up to three years have been allowed so far.¹

If the standards are violated, the Department may initiate action for breach of the standards.² Sanctions under the Act are only \$10 a day³ and provide little incentive in themselves to control air pollution. However, in practice in New South Wales, the publicity attendant upon prosecution for violation of the standards has provided sufficient incentive to keep emissions within the established limits. The Minister of the Department of Public Health also has the power to prohibit the occupier of premises from emitting if injury to public health is likely,⁴ but this power has never been used. The Department of Health has resorted to enforcement sanctions in only a few instances in which accidental, temporary violations have occurred. In all of these cases, the alleged violator has pleaded guilty. In general, apart from a few minor cases of accidental and temporary violations, enforcement is

1. J. L. Sullivan, "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 431. Under the experience to date, exemptions have never been absolute but have been subject to conditions stipulated by the Air Pollution Control Branch. One such stipulation would require a report from the firm every three months on control progress. Information from J. L. Sullivan, October 21, 1970.

2. Ibid. Prosecution is for breach of the regulations set through Sections 15 and 19.

3. Ibid., Section 32(3).

4. Clean Air Act, 1961, Section 25.

dependent on the cooperation of industry; thus far in New South Wales, industry has been cooperative.¹

Monitoring and Testing

Determination of whether emission standards are complied with and whether control technology is called for depends in large measure upon testing at the source. Source testing is one of the primary functions of the Air Pollution Control Branch of the State Department of Public Health. Access for purposes of testing is facilitated by a provision of the New South Wales Clean Air Act that occupants of scheduled premises must provide entry to stacks, platforms, and so forth, as deemed necessary for testing by the Air Pollution Control Branch principal engineer.² Regulations appended to the Act define the methods of making tests and specify that the place at which tests are to be made shall be determined by the principal engineer.³

New Industrial Facilities

The New South Wales Clean Air Act also requires that all new industrial facilities must be officially approved:⁴

This applies to new projects as well as to further developments on existing premises. In the former case, approval for the site for the location of the industry is required before the actual installation

1. Information from J. L. Sullivan, former Principal Engineer, Air Pollution Control Branch, October 21, 1970.

2. Clean Air Act, 1961, Section 27.

3. Ibid., Regulations, as amended, Section 18(1).

4. Clean Air Act, 1961, Section 16.

is considered. When the proposal reaches the plan stage, it is considered further and any control measures or procedures needed would be specified in the approval.¹

The approval of siting and construction plans before construction can begin has proved very effective. Apparently, new plants are now being held to a higher standard of control technology than existing plants in order to allow for future restrictions on the level of the emission standards.² Although problems may arise concerning approval of future emitters,³ the New South Wales approach provides a great deal of control over such problems.

Additional Control Authority

Emission standards are not the only air pollution control techniques used in New South Wales, because frequently the emission standards by themselves would result in poor ambient air quality.⁴

1. J. L. Sullivan, "Australian Air Pollution Legislation," Journal of Air Pollution Control Association, Vol. 15 (1965), p. 432.

2. J. L. Sullivan and G. J. Cleary, "Industrial Air Pollution Control by Emission Standards," paper presented at Joint Meeting of American Chemical Society and Canadian Institute of Chemists, May 26-27, 1970, p. 12.

3. Sullivan and Cleary, in their above-cited article, outline an example of this in New South Wales. It was estimated by the Air Pollution Control Branch that a new plant would double the permissible particulate emissions, but the plant convinced the agency that its new equipment would not violate the standard. The actual emissions were twice the standard, but by then economic considerations to the plant and surrounding community precluded effective immediate control. See Sullivan and Cleary, "Industrial Air Pollution Control by Emission Standards," p. 13.

4. Information from J. L. Sullivan, October 21, 1970.

High concentrations of pollutants could result, even though all plants are operating within the emission standards, because there are a large number of polluters in an area or because of meteorological conditions, for example, a temperature inversion. To prevent high concentrations, which cause poor ambient air quality, the New South Wales system includes other methods of controlling pollution of the air.

The Clean Air Act allows the control agency to regulate the height of chimneys and stacks,¹ to order installation of control equipment,² and order the repair, alteration, or replacement of installed control equipment.³ There has been frequent use of these powers, particularly to require construction of taller stacks.⁴

Authority is also given under the Act to prohibit the use in a particular area of certain types of fuel, fuel burning equipment, or industrial plants.⁵ The first two restrictions have been used, particularly by restricting the type of fuel that a polluter

1. Clean Air Act, 1961, sections 17(1)(c) and 20(1)(c).

2. Ibid., sections 17(1)(a) and 20(1)(a). This is somewhat similar to the Standards of Performance for New Stationary Sources established by Sec. 111 of the American Clean Air Act Amendments of 1970.

3. Ibid., sections 17(1)(b) and 20(1)(b).

4. Information from J. L. Sullivan, October 21, 1970. See also R. P. Murphy, "Air Pollution and Urban Development", Royal Australian Planning Institute Journal (July, 1970), pp. 67-76.

5. Clean Air Act, 1961, section 24.

could use.¹ However, there are no indications that existing industrial plants have ever been prohibited from operating under this provision. The government's authority to prohibit planned industrial plants has been discussed already under New Industrial Facilities.

In conclusion, the ability to require use of specified control techniques is an important complement to a pollution control system based on emission standards. The additional controls available under the New South Wales Clean Air Act allow the pollution control agency to adapt its policy regulations to control adequately air pollution in areas where the standards by themselves would not be adequate.

Summary and Conclusions

The New South Wales system is based essentially on emission standards. Generally speaking, the system seems to have worked well. However, there have been suggestions that both standards and enforcement need to be strengthened.² The most significant proposed new legislation, motor vehicle emission control,³ appears to have

1. Most frequently restrictions have been those on sulfur content. Information from J. L. Sullivan, October 21, 1970.

2. R. P. Murphy, the present Principal Engineer of the Air Pollution Control Branch, indicates that amendments have been proposed that would cover motor vehicle emission control, urban planning, increased penalties, more stringent emission standards for new plants, increasing the types of plants that are controlled, and standards for additional pollutants. Letter of March 10, 1971.

3. R. P. Murphy, "Air Pollution and Urban Development," Royal Australian Planning Institute Journal (July, 1970), pp. 67-76.

arisen largely because the New South Wales Clean Air Act of 1961 does not deal with mobile source pollution. In the following discussion, attention is focused upon the possible relevance to the U. S. of the New South Wales approach.

Focus on Major Pollutants

The emphasis in New South Wales on controlling the major pollutants and major emission sources is one of the system's principal strengths. Because there are hundreds of potential pollutants it would be impractical--at least initially--to attempt to regulate and test each one. Similarly, regulation of every emission source, if one includes fireplaces, incinerators, and industrial stacks, is not administratively feasible. These problems are even more significant for air pollution control in the United States, where, given the large number of pollutants and emission sources, some similar focus is desirable.

Focus on Premise

Enforcement in New South Wales focuses on all emissions from a particular industrial location. By way of contrast, in Great Britain an inspector can test only the emissions from a particular industrial process, for example, a sulfuric acid plant, while an inspector in New South Wales tests all emissions from processes at a particular industrial location. Hence, while the British inspector would have to ignore violations not pertaining to his particular process, the New South Wales inspector does not have to do so. Experience in New South Wales suggests that inspection

and enforcement should focus on entire premises rather than on a particular industrial process.

Preventive Measures

A further strength of the New South Wales system is its ability to prevent new industrial facilities from creating future air pollution control problems. While there may be economic hardship in requiring an existing facility to comply with emission standards, new facilities are being built with the knowledge that standards must be complied with to prevent future pollution problems.

The power plant planning legislation proposed by the Office of Science and Technology, discussed below under Electric Power and the Environment in Chapter 4, is similar to the control of new facilities in New South Wales. The proposed U. S. legislation deals only with power plants, but it provides for prior approval of plant sites and construction plans, much as is required in New South Wales. The principal difference between the two is in the degree of direction provided. The proposed U. S. legislation is more detailed and therefore, less flexible, while the New South Wales is less detailed and therefore less indicative to industry of exactly what is expected. At the same time, of course, the New South Wales legislation is less restrictive for those who administer the Act. The proposed U. S. legislation provides for long-range planning, a minimum of ten years in advance of construction, while in New South Wales approval need only be granted at some unspecified time before construction begins. In conclusion, the New South Wales provisions

for preventive action are similar to those contemplated for the U. S.; experience with the former would suggest that planning controls can be put to good use in this country.

Importance of Public Opinion

The importance of public opinion in inducing compliance with emission standards in New South Wales is difficult to over-emphasize. While "the penalties are not effective at all,"¹ the prosecution of polluters has been much in the news. Because of this, the firms do not like to be prosecuted because of the adverse public relations. For example, from June, 1963 to June, 1968 a survey indicated that \$39,910,000 was spent on air pollution equipment-- of this amount the steel industry and power plants were most significant, with 34.2 percent and 28.2 percent, respectively.² Public opinion is a crucial factor in "controlling air pollution,"³ and it can play an important role in inducing voluntary compliance with pollution control requirements in the United States just as it has in New South Wales.

Government Technical Expertise

The technical capability of the air pollution control agency is another important element in the New South Wales system;

1. Information from J. L. Sullivan, October 21, 1970.
2. R. P. Murphy, "Air Pollution and Urban Development," Royal Australian Planning Institute Journal (July, 1970), pp. 67-76.
3. J. Clarence Davies III, The Politics of Pollution (New York: Pegasus, 1970), p. 77.

it allowed the agency to establish emission standards consistent with the available control technology. In addition, the agency's technical capability has been necessary to enforce the standard in court, since:

very often a company will make the objection that the standard that has been set is not practical in his particular case, and will use this as a defense. If he can convince a judge that the standard is not realistic, then it is likely that the prosecuting organization will lose the case. And so it is necessary for the organization to know that it's possible to meet the standards in each particular case and to be able to give convincing evidence that by using particular equipment the standards can be achieved. So that I think for this reason, it is necessary to have expertise in the controlling organization.¹

Response of Industry

An interesting consequence of the creation of the New South Wales system has been the desire on the part of many industries to be regulated by the air pollution control agency. There were two basic reasons for this attitude. First, the agency has been very willing to cooperate with industry to help solve their pollution control problems. The agency's technical capability, discussed above, has been extremely important in this regard. Second, and perhaps most important, industry preferred regulation by New South Wales to regulation on the part of local governments. The latter were inclined to be "uneven" in approach, that is, either too lenient or too restrictive. In New South Wales:

1. Information from J. L. Sullivan, October 21, 1970.

City councils could be rather erratic in their actions and sometimes they more or less carried out harrassing programs, which were sometimes not related to air pollution, but related to other things for which they could use Clean Air Act to achieve the harrassment. The industry sometimes became sick of this. This is one reason why industry was rather keen on the Clean Air Act, because it put them in the control of people that could understand what they were doing and could also give advice. Air pollution control can only be carried to a certain point and this point doesn't always satisfy immediately all the needs of all portions of the community. Sometimes communities just don't like industry in their particular location and sometimes this provides erratic or unreasonable pressures on industry. For this reason, some industries were in favor of the legislation. This doesn't mean they got off lightly with the Branch, but they at least know that whatever pressures were put upon them would be put upon them for technical reasons.¹

The New South Wales agency required that the industries reasonably control their pollution, but did not require firms to go out of business. As a result, many industries petitioned to be included on the list of significant potential sources of air pollution² since this would place them under the control of the state, instead of local government.

The problems of inconsistent enforcement found among the cities of the state of New South Wales are analogous to those among the various states in the United States. With each state establishing different emission standards (where they were established at all), inconsistencies have developed in the United States as they did in

1. Information from J. L. Sullivan, October 21, 1970.

2. Ibid.

New South Wales. Consequently, many American industries which initially opposed national emission standards have subsequently reversed their position as protection against the possible proliferation of state emission standards.

Need for Combination of Controls

Finally and perhaps most importantly, the New South Wales system demonstrates the need for emission standards to be supplemented by other means of assuring ambient quality. While emission standards are effective generally, they may not be effective in locations where there is little wind and there are frequent inversions or densely-grouped emission sources. An emission standard will not be effective in these circumstances and additional controls will be needed. Otherwise, a system of emission standards may result in insufficient control where emissions are heavily concentrated, and these are the very places where air pollution control is most crucial.

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CHAPTER 10

CRITERIA DEVELOPMENT AND EVALUATION¹

The development of criteria for evaluating approaches to air pollution control is a complex task requiring many judgments. An initial issue concerns the time frame for which criteria should be developed. In the following analysis, primacy has been given to those criteria which should be considered in setting priorities for the coming five to ten years or more. Given this time frame, an approach should demonstrate superiority over other approaches in terms of its effectiveness and its economy in meeting a given air pollution control objective. The best approach, in other words, is that which can actually achieve a given air pollution control objective at least cost.

Implicit in the criteria of effectiveness and efficiency is the concept of administrative feasibility. Administrative feasibility comprehends such considerations as administrative costs, communicability, information requirements, and so forth.

Other criteria, which may be important in the immediate future but which might preclude consideration of innovative approaches, could have been accorded primary status. For example, if the availability of enabling legislation were a primary consideration, emission

1. The authors acknowledge with appreciation the careful review and valuable criticism of an early draft of this chapter by Paul Gerhardt and Ken Woodcock of the Office of Program Development, Office of Air Programs, Environmental Protection Agency.

charges and many forms of economic incentives would not meet this criterion. It was felt, however, that such criteria might confine the present evaluation to a critique of minor deficiencies in present programs rather than a broader look at long-range opportunities.

In selecting criteria, two factors were considered in addition to the above considerations of long-term advantage: (1) the availability of analytical and/or factual information to support the criterion; and (2) the practicality of their application at the present time.

There are many important considerations which cannot, for reasons discussed below, be used for evaluation at the present time. These "other considerations," include: administrative costs, communicability, information requirements, political acceptability and susceptibility to legal challenge. Some of these considerations, assuming information and/or analysis become available to support them, can be expected to become increasingly important in evaluating approaches. Neither effectiveness nor efficiency, however, is expected to be dropped or replaced by other criteria.

A final issue raised by the development of criteria concerns the limitations on this methodology, both now and for the future. Perhaps the principal result of the methodology adopted for this project is that, in the process, it was necessary to explore all the relevant possibilities. The usefulness of developing criteria has been primarily to permit a selecting-out procedure whereby those approaches least likely to offer long-term advantage could be eliminated.

Given the limited knowledge at present on approaches to air pollution control, this methodology has been useful, although there are some limitations upon using this methodology in the future.

To begin with, there is a strong tendency today to state numerically as many as possible of the variables with which public policy must deal. Quantitative measures are undoubtedly useful; but undue confidence in numerical values can have undesirable consequences, particularly where some arbitrariness exists and where synergistic effects need to be taken into account. Consequently, quantification of criteria should proceed only to the point where knowledge is sufficient to support it.

Another limitation on the use of this methodology is that comparing all of the general approaches is often insufficiently precise to enable predictions of the consequences of specific control programs. Only in relatively restricted areas (e.g., criteria as to effectiveness and efficiency) can approaches be compared with sufficient precision to go far in resolving policy questions. As emphasized throughout, the pros and cons of general approaches under many criteria depend upon the specific provisions of the enabling legislation and/or the way in which legislative mandates are actually carried out. Further policy-oriented research, therefore, should be more focused on the specifics of the most promising approaches.

A third and final limitation is that, while a comparative evaluation with criteria may indicate in a general way which approaches are preferred, it cannot indicate how to proceed from the present

situation to reach the preferred state of affairs. This question is the subject of the concluding section in this chapter.

With these caveats in mind, we can proceed to set forth the criteria and evaluate the approaches¹ below. The following, it should be recognized, cannot attempt to summarize and compress in one concluding chapter the mass of material contained in the compendium. Consequently, only the most significant conclusions are stated here, along with references to more complete discussions in previous chapters.

Primary Considerations

The effectiveness and economy criteria may seem obvious, but many approaches (e.g., cost sharing measures) continue to be advocated even though, on the basis of analyses in this study and

1. The approaches which are evaluated--each of which is examined in detail in separate chapters of the compendium--include: emission standards, land use controls, private legal action, cost sharing measures, economic incentives and emission charges. Two other chapters in the compendium are not covered here: voluntary compliance and the New South Wales system. As emphasized in Chapter 2, the techniques of education, persuasion and negotiation do not constitute, strictly speaking, an approach to air pollution control. The significance of these techniques is insofar as they can support the other approaches identified above. Relevant questions in this regard (e.g., what degree of voluntary compliance can be expected from the private sector and what can government do to encourage voluntary compliance) are dealt with in Chapter 2. The New South Wales system, discussed in Chapter 9, consists of a combination of approaches (what is called an air pollution control "program" in this compendium), as applied in the most populous and heavily industrialized state of Australia. Because this program is not, strictly speaking, a separate approach, and because of the different institutional setting of that country, it is not evaluated here.

elsewhere, they cannot conceivably be expected to be either effective or economical.¹

The usefulness of these two criteria, therefore, is primarily to permit a selecting-out procedure, whereby those approaches least likely to offer long-term advantage can be eliminated from further consideration. To anticipate the argument below, land use controls, private legal action, cost sharing measures and most economic incentives can serve only as supplements to--and not as substitutes for--other more effective and economical approaches such as emission standards and emission charges.

Effectiveness

An effective approach is one which can be reasonably expected (1) to decisively induce individual polluters to abate air pollution and (2) to apply to a broad range of pollution control problems. No empirical evidence exists on the actual pollution abatement achieved by the various approaches examined in this compendium or the range of air pollution control problems to which approaches apply; reliable data are difficult to assemble in part because of differences among geographic areas and the fact that some approaches have yet to be tried. We must, therefore, make do with assumptions as to performance.

1. Cost sharing measures may be advocated for other objectives related to reducing emissions, e.g., to ease undue burdens upon industry. See below, "Considerations of Equity."

Emission Standards. The establishment of emission standards and the prosecution of those who violate them is the prevailing approach in the United States today. The enforcement procedures and experience under this approach have been reviewed in detail in Chapter 3. As emphasized there, the enforcement of emission standards depends upon a high degree of voluntary compliance.¹ Nevertheless, the experience to date suggests that emission standards--when backed by stiff legal penalties and/or fines and vigorous action on the part of air pollution control agencies--can deter individual polluters. Furthermore, this approach can be applied to a wide range of air pollution control problems. For example, it is generally acknowledged that the standards approach has been effective in controlling stationary source air pollution in localities such as Los Angeles.²

1. The requirement for voluntary compliance, of course, is the case for most laws and standards. Nevertheless, air pollution control poses problems quite different from other areas of law enforcement, as emphasized in Chapter 3. The facts that enabling legislation and social norms are far less developed for air pollution control, that there are difficulties in recognizing "unacceptable behavior" where pollutants are odorless and invisible, and that decision centers which must be affected are very decentralized--these are all problems which may limit the effective extent of voluntary compliance under an emissions standards approach to air pollution control.

2. This has also been the experience in controlling some mobile source air pollution with emission standards on automobile exhausts. In the two years since the establishment of standards for 1968 model vehicles, 69 percent control over hydrocarbon emissions and 60 percent control over carbon monoxide emissions have been achieved. See, First Annual Report of the Council on Environmental Quality, Environmental Quality (Washington, D.C.: Government Printing Office, August, 1970), pp. 76 ff. and Institute of Public Administration, Governmental Approaches to Automobile Air Pollution, report submitted to the Office of Air Programs, Environmental Protection Agency, Washington, D.C., 1971, pp. 1-11 ff. (Mimeographed.)

Land Use Controls. Various land use controls might be used to disperse pollution from stationary sources and/or to reduce the exposure of humans (particularly in dense population centers) to pollutants. The experience to date with these techniques and the growing interest in their application to air pollution control are discussed and analyzed in Chapter 4. It is apparent that land use controls are far from being an entire answer to the air pollution problem. Existing land use and urban design, as well as the location of most industrial facilities, cannot be greatly altered, at least for a decade, so that, short of shutting down major polluters, land use controls can do little to abate stationary source pollution. Furthermore, dispersion is no solution to the problem (if there be a problem) of overloading the earth's air mass with pollutants.

Answers as to the long-range effectiveness of land use controls in air pollution abatement must await further research, for example, as to what kinds of dispersion will make for maximum abatement of pollution damages. There is also need for research on the administrative and political limitations of land use controls. The political weakness of most local planning agencies, the disjointed planning process, the patchwork nature of local jurisdictions and the competition among individual communities to obtain industry may turn out to be major constraints.

Private Legal Action. Private legal action can be used even in the absence of federal, state or local legislation to obtain relief from air pollution by recourse to common law rights such as

nuisance and trespass. What is more, recourse to the legal process is becoming increasingly feasible with the passage of such anti-pollution legislation as the 1970 Michigan Environmental Protection Act. Particularly in recent years, pollution control suits have been stepped up dramatically both by private citizens and by the growing body of public interest lawyers.¹ Although environmental control in other areas has been advanced in the process, few, if any, victories of consequence have been registered for air pollution control.²

The ineffectiveness of private legal action to date as an approach to air pollution control may be explained by the numerous and important limitations on litigation in this area. As discussed in Chapter 5, these include limitations of rights (both procedural and substantive), limitations of remedies (both with respect to injunctions and money damages), and limitations of the judicial system (most importantly, the restricted capacity of courts to handle environmental cases).

Given the above, the effectiveness of private legal action is limited, particularly with respect to the range of air pollution control problems which can be covered. Procedural problems (e.g., standing, considerations of time and cost, the statute of limitations)

1. Among the notable environmental achievements of public interest lawyers during 1970 were the injunction delaying a federal permit for the Alaskan oil pipeline and the issuance of notices for cancellation on all uses of the pesticide DDT and the weedkiller 2,4,5-T.

2. This refers, of course, to private legal action, not government legal action as in the enforcement of emission standards.

preclude private legal action in many cases. And even where these are overcome, the need for plaintiffs to prove proximate causation prevents most polluters from being brought to court since rarely can the responsibility for damages be traced to individual polluters.¹ Moreover, proximate causation is usually impossible to be shown where synergistic effects occur. And where pollution control requires preventive action, the prosecution of an "anticipatory nuisance" is extremely difficult.

Even assuming a plaintiff can overcome procedural problems and is able to show that his rights have been violated, there is no certainty that pollution will be controlled. Injunctions can require the cessation of emissions or the installation of control equipment, but the difficulties in obtaining injunctive relief (e.g., balancing the equities) have made it rarely utilized, at least in the past, for air pollution control. More commonly, money damages may be obtained, but the size of the court award--although adequate to compensate the offended plaintiff--is seldom sufficient to induce polluters to apply abatement.

From the standpoint of effectiveness, probably the most basic problem with private legal action is the limited capacity of courts to handle pollution control cases, both in terms of the technical competence which judges would have to acquire and the adverse effects of private legal action for pollution control on

1. Showing proximate causation is difficult except in rare instances where the pollution source is immediately adjacent to the plaintiff, or where a single source is polluting in a sparsely-settled area. Thus, the causation problem is most onerous precisely where air pollution is most a problem--in areas of great population and industrial concentration.

courts already clogged with large backlogs of cases.¹ Suggestive of the severe constraints on courts in handling pollution cases was the recent ruling (in an eight-to-one decision) by the Supreme Court that it had neither the time nor the expertise to play a major role in pollution control litigation.² The Court declined to hear a suit brought by the State of Ohio against three chemical companies accused of dumping mercury into Lake Erie. It warned that the Supreme Court could be swamped with "a host of such actions" if it agreed to hear pollution suits that had not first been tried in the lower courts.

Strictly speaking, the Court's decision served notice only that it would not exercise the original jurisdiction conferred upon it by the Constitution to give states a forum to attack water and air pollution that crosses state and national boundaries. However, the opinion stressed that state, federal and international agencies had been set up to control pollution. Thus, Justice John M. Harlan stated that it would be imprudent for the Court to divert its energies from deciding appeals "to the task of trying to settle a small piece of a much larger problem that many competent adjudicatory bodies are actively grappling with on a more practical basis."

1. In a "State of the Judiciary" address to the American Bar Association on August 10, 1970, Chief Justice Warren Burger warned against "our tendency to meet new and legitimate demands with new laws which are passed without adequate consideration of the consequences in terms of caseloads."

2. Fred P. Graham, "High Court Curbs Pollution Cases," New York Times, March 24, 1971, p. 28. Quotes from the opinion are taken from this article.

He also observed that mercury pollution was a novel scientific issue and that eight other companies had been accused of contributing to mercury pollution in Lake Erie. Implicit in this decision was the Court's reluctance to add to its already overloaded calendar.

As a result of this opinion, virtually all pollution control litigation in the future will originate in the lower courts. At the very least, this means pollution control suits will continue to be long and drawn out and adjudication will be inconsistent, often dependent on the locale and the court. New pollution control litigation may be discouraged and the effectiveness of courts in handling existing cases will continue to be limited.

Some have argued that private legal action can play a major role in controlling pollution.¹ While it is not clear just how major the role of private legal action could be, it should be recognized that litigation cannot, by itself, adequately solve the problems of pollution. Because of the difficulties inherent in the legal process, private legal action can play only a supplementary role,² not substitute for other more effective approaches. Measured against the magnitude of the pollution control problem, the effectiveness of private legal action--both upon individual polluters and for a broad

1. The leading proponent of this approach is Professor Joseph Sax of the University of Michigan, who drafted the 1970 Michigan Environmental Protection Act and several similar bills currently under consideration by the U.S. Congress.

2. Specific suggestions as to the supplementary role of private legal action are made in Chapter 5, "Summary and Conclusions."

range of pollution control problems--is extremely limited.¹ Nevertheless, private legal action can serve as a useful supplement to other more effective air pollution control approaches.

Cost Sharing.² Measures grouped under the cost sharing category have as their defining characteristic that only part of the cost of pollution control is borne by government. The experience to date with these measures (and specifically the extent of subsidy given to industry) is reviewed in Chapter 6. Even under the most favorable conditions, however, the subsidy to firms cannot possibly make the investment in air pollution control profitable. Therefore, while cost sharing measures may have other applications (e.g., to ease undue burdens to industry) they cannot be expected--in and of themselves--to provide a decisive incentive to air pollution control.³

1. For a similar conclusion, see Milton Katz, "The Role of the Legal System in Society's Implementation of Technology Assessment" (paper presented to Technology Assessment Seminar, George Washington University, May 7, 1971).

2. The discussion distinguishes between cost sharing measures, which remove only a part of abatement costs from industry and therefore provide no net incentive for abatement, and economic incentives, which offset or more than offset the costs of abatement and therefore make it more profitable to abate than to pollute.

3. Cost sharing measures may motivate pollution control where the recovery of valuable by-products would result from the control process and where the cost sharing subsidy would be sufficient to make recovery profitable. This possibility is of limited practical importance, however, since the proportion of these possibilities is small relative to the total number of polluters which must be controlled and since the enabling legislation of most cost sharing measures explicitly excludes their application where by-product recovery is involved.

Economic Incentives. As noted in Chapter 7, most economic incentives have not been tried in the air pollution field. But, based on the experience of analogous economic incentives in other areas of government (e.g., direct contracting by the Department of Defense) it can be concluded that these measures can act as decisive incentives to individual firms. The extent of incentive will depend upon the level of the subsidy or tax. A tax on the sulfur content of fuels, for example, would have the effect of increasing the costs for all firms using these fuels. When a sufficiently high tax is imposed, some firms will decide (assuming control technology is available) that some methods of abatement are less expensive than paying the tax and will reduce emissions (e.g., by switching to low sulfur fuels). The higher the tax the greater will be the response. And, at a very high level of taxation, almost all firms can be expected to find that extensive pollution abatement is profitable.

Although economic incentives can be effective in individual cases, the range of pollution control problems to which they can apply is limited. Neither direct contracting nor depletion allowances have broad applicability. The former is limited by numerous inherent biases and by difficulties in contract administration. The latter (e.g., a depletion allowance for low sulfur fuel) is limited to those cases where fuel substitution is possible. Taxes, the other major form of economic incentive, could be widely used. However, to the extent that taxes are based upon surrogates for emissions (e.g., the sulfur content of fuels) as opposed to emissions per se (e.g., sulfur oxides) they are less effective (and economical) than emission

charges.¹ Thus, economic incentives based on taxes tend to be more effective (and economical) the more they approximate an emission charge system.

Emission Charges. Chapter 8 notes that this approach has not been applied to air pollution control. If experience with effluent charges for water pollution control is any indication, however, polluters might be reasonably expected (assuming the charges could be imposed and administered) to respond to charges by reducing emissions and/or increasing treatment of wastes. The extent of response would depend upon the level of the charge.

The range of air pollution control problems to which emission charges could apply is not now known. In practice, the determination will probably hinge on the degree of abatement desired (a complete restriction on highly toxic emissions, for example, would best be handled by emission standards), the comparative costs of administering approaches (if charges require expensive emission monitoring devices, the approach may not be suited to sources such as backyard incinerators with low levels of emissions), and other factors.

1. The important distinction between taxes based on surrogates for emissions and charges based upon emissions per se is brought out in Chapters 7 and 8. Which approach is used depends upon the trade-off between effectiveness and economy on the one hand and administrative feasibility (specifically the information required) on the other. Emission charges are clearly more effective and economical (by not precluding any method of pollution control) than economic incentives consisting of taxes on surrogates for actual pollution. But the latter may be easier to administer if information on emission surrogates is already available (e.g., data on the amount and sulfur content of power plant fuels submitted annually to the Federal Power Commission).

In principle, the emission charges approach is applicable to a wide range of pollution control problems, although the practical advantages of this approach over others for dealing with specific pollutants and industries must await further research.

Economy

An approach is to be preferred if it encourages use of least-cost combinations of air pollution controls. Costs may vary within firms (e.g., according to which methods are applied) and among firms (e.g., according to differing marginal costs of control among firms in a given area). If the objective is primarily to encourage the least-cost combination of air pollution controls within a given area (e.g., an air quality control region), economy in this sense is furthered when each polluter is encouraged to employ his least-cost method of control and when those polluters in the area with the lowest marginal costs of control are encouraged to abate the most.

Air pollution control approaches may not encourage economic efficiency for reducing a given amount of air pollution for any of the following reasons:¹

1. Bias toward certain control techniques and technologies which are not necessarily the most effective;
2. Requirement for an across-the-board (uniform) reduction in emissions which costs more than

1. The first reason refers to economy within firms; reasons 2, 3, and 4 refer to economy among firms.

approaches requiring selective abatement to meet the same control objective;¹

3. Lack of continuing inducement to reduce emissions below a given level (as requirements approach a 100-percent reduction, of course, this consideration diminishes in importance); and

4. Requirement for the immediate application of control techniques and technology which are not available, leaving polluters only the alternative of shutting down.

Implicit in the above is the assumption that costs of control at the source can vary considerably from firm to firm, even within a single industry. Furthermore, it is assumed that the least-cost method of control at each source is closely related to the production process involved. Even if commercially-proven control technology is available, therefore, the least-cost method of abatement may entail a complex combination of responses on the part of the polluter, including changes in raw materials, recycling, treatment of wastes and so forth. Consequently, any approach which requires specific methods of abatement may well result in greater costs. Moreover, approaches which require specific abatement devices may destroy the inducement to develop alternative techniques and technologies.

The problem of encouraging the least-cost combination of measures for an area is exceedingly difficult, for there is usually no single source whose abatement would solve the air pollution problem. There are more likely to be numerous sources that contribute different

1. An approach which simply calls for an equal percentage reduction from all sources ignores differences in the marginal costs of control among various polluters.

elements of air pollution. Achieving the desired quality of ambient air in an economically efficient manner thus involves imposing air pollution control on a large number of polluters, beginning with those having the lowest marginal costs of abatement.

Emission Standards. Assuming methods of abatement are available, the technological bias resulting from emission standards is probably negligible. Generally, the standards approach requires application of the best available technology (consistent, of course, with economic feasibility). There may be some danger that specific abatement techniques and technologies become frozen under the standards approach (e.g., if air pollution control officials become wedded to pet control methods). This possibility will depend upon the degree to which the air pollution control agency fails to keep up with latest available abatement techniques.

Another possibility is that the standards approach may be unnecessarily costly because it disregards the different costs, to different firms and industries, of meeting a uniform standard. Available studies of this subject (cited in Chapter 3) conclude that the uniform standards approach would cost from two to seven times as much as an approach which allows variations in emission reductions while meeting the same area-wide air pollution control objective.¹

1. One way out of this problem under the emission standards approach would be to impose varying standards on different firms and industries. Chapter 3, however, points out that non-uniform standards raise other problems of administration (e.g., the difficulty for pollution control officials in determining marginal control costs for individual polluters) and equity (e.g., the perception by some industries that

Another drawback of emission standards--from the standpoint of encouraging the least-cost form of control for any area--is that polluters have no inducement to reduce emissions below the standard. In contrast, an emission charge, since it is continually costing the polluter money, will offer a continuing incentive for pollution reduction to the point where incremental cost of control at the source equals the charge. (As standards approximate a 100-percent reduction requirement, of course, the need for a continuing incentive is negligible.)

Land Use Controls. The potential economy of land use controls is small because of the limited effectiveness of this approach. Given the fact that land use controls cannot deal with most air pollution problems, an area-wide least-cost control program is not possible. Furthermore, land use controls are obviously biased towards certain forms of pollution control. Whether methods such as relocation of facilities, chimney construction, increasing the heights of existing stack and so forth are the least-cost solution to a particular pollution control problem would have to be decided on the merits of each case. For example, is transmitting electricity from power

competitors in an area are being treated differently.) Furthermore, the trend in the past decade has been toward uniform emission standards, first on an area-wide level and then on a national level. Under the 1970 Clean Air Amendments, for example, the Federal Government is now committed to national emission standards for all hazardous air pollutants and for all new sources (defined as any stationary source, the construction or modification of which began after the publication of applicable performance standards) whose pollution would endanger public health or welfare.

plants in remote areas a cheaper alternative than burning low-sulfur, but premium-priced, natural gas at a site near population concentrations? And, what are the implications of the facts that plant location implies a long-term investment and that natural gas is a resource in short supply?

To the extent that land use controls apply uniformly to all polluters, the land use controls approach would ignore differences in the marginal costs of pollution abatement among various emitters. A selective application of the approach, designed to reduce costs, would probably prove difficult to administer and might raise questions of equity.¹

A final disadvantage of land use controls from the standpoint of economic efficiency is that, once these measures have been applied, there is little continuing incentive for polluters either to reduce emissions and/or to develop new methods of control.

Private Legal Action. The potential economy of private legal action is small because of the limited effectiveness of this approach--it cannot deal with most pollution control problems, and hence precludes an area-wide least-cost control program.

For those few polluters affected by private legal action, the major bias against an area-wide least-cost solution arises among

1. Many long-range land use plans have been designed for American cities, only to be destroyed by zoning alterations resulting from economic pressures.

firms.¹ When a private party decides to sue a polluter, the decision is rarely made with reference to which polluters in the area can reduce emissions at least cost. Furthermore, when courts decide to grant money damages or injunctive relief, they rarely consider the costs of pollution reduction.² As a result, least-cost solutions are not automatically encouraged--indeed, are unlikely to obtain--for an area as a whole. Finally, private action is not feasible in cases where commercially-proven methods of abatement are unavailable.

Cost Sharing. The numerous biases of cost sharing measures have been discussed in Chapter 6. Among other things, cost sharing measures are usually biased toward capital intensive methods since they generally subsidize capital costs but not operating and maintenance, not to mention overhead, costs. Capital costs probably account for less than a third of total air pollution abatement costs for most firms. This approach tends to discourage the least-cost solutions by promoting construction of capital intensive treatment facilities where

1. Within individual firms, private legal action may bias choice of abatement techniques. For example, in granting injunctive relief, courts have been known to specify control methods (e.g., installation of electrostatic precipitators). This probably is not a major problem, however; assuming some technical competence on the part of judges, they would doubtless agree to other less expensive forms of control if these could be shown to achieve at least as much abatement.

2. In "balancing the equities" courts may weight the costs of closing down the polluting source against the costs of pollution to the aggrieved party, as well as other factors. Nevertheless, none of these considerations take into account the differing marginal costs of control among relevant polluters for the area as a whole.

process changes, recovery of valuable by-products, changes in raw materials, etc. might achieve the same result at lower cost.

Finally, cost sharing measures are generally sufficient in encouraging continuous pollution abatement efforts and developing new methods of control.

Economic Incentives. One form of economic incentives--that of direct contracting--suffers from many of the same biases as do cost sharing measures, because it encourages both government and industry to rely most upon those abatement techniques which can be most easily administered and justified. Thus, direct contracting is biased, among other things, against combined facilities, against operation and maintenance costs, against process changes and against by-product recovery. Therefore, the same problems resulting from these biases, problems discussed above in connection with cost sharing, also apply. In addition, there are several administrative difficulties (discussed in Chapter 7) which tend to reduce the cost effectiveness of direct contracting.

Taxes on emissions tend to encourage economic efficiency. Taxes on surrogates for emissions, such as sulfur content of fuel, are less efficient. For example, a tax based upon the fuel induces firms to alter the fuels used, not to control emissions through recovery and/or treatment.

Emission Charges. Of all the approaches considered in this compendium, emission charges have the most potential for encouraging the least-cost combination of air pollution controls for any given

area. This is the conclusion of all the available studies on the subject (see Chapters 3 and 8). Emission charges encourage the least-cost combination of control for four major reasons.

First, charges are neutral toward all methods of pollution prevention, abatement and control. Faced with an emission charge, a polluter can: (1) close down, (2) relocate his facility (conceivably outside the country), (3) alter his product, (4) change his raw materials, (5) change his processing technology, (6) recycle his wastes, (7) reclaim his wastes, (8) treat his wastes, (9) dispose of his wastes elsewhere, (10) pay someone else to treat his wastes, (11) pay the charge, or (12) evade the law.¹ Assuming firms are profit-maximizing (or more correctly, for purposes here, cost-minimizing), the polluter will choose that response which is least costly. Emission charges, since they are neutral with respect to the response to be taken, offer the distinct advantage of allowing polluters the entire range of possible responses, thereby enabling selection of the least-cost solution.

Second, charges enable a given air pollution reduction target to be reached less expensively than across-the-board emission

1. This list of possible responses was compiled from Robert U. Ayres and Susan C. Simon (International Research & Technology Corporation), "Policy Alternatives for Environmental Management" (paper prepared for a Technology Assessment Seminar, George Washington University, March, 1971), pp. 5 and 22 (mimeographed). From an environmental control perspective, however, the desirability of different air pollution reduction methods may vary. For example, limestone injection processes for removal of SO₂ from stack gases produce a sludge which must be disposed of as solid waste. This suggests that pollution control programs should also attempt to ascertain what other forms of pollution are created as side effects of air pollution control.

standards. By tacitly taking into account differences in the marginal costs of pollution control among various emitters, emission charges would encourage those polluters with low abatement costs to abate first and most.¹

Third, charges encourage continued efforts to reduce pollution up to the point where it vanishes. Most approaches offer no such continuing incentive.

Fourth, and of great importance for the medium and long-term, emission charges induce polluters to devise new methods of abatement. This is worth considering briefly since a system of emission charges would be the only approach whose immediate application would encourage control even in the absence of commercially-proven techniques and technologies.

As an instance of a field for potential innovation, a National Academy of Engineering panel, following a review of U.S. and foreign processes to control sulfur oxides, concluded recently that "contrary to widely held belief, commercially-proven technology for control of sulfur oxides from combustion processes does not exist," and warned that:

Efforts to force the broad-scale installation of unproven processes would be unwise; the operating risks are too great to justify such action, and

1. The economics of this and the following two reasons are discussed in a recent doctoral dissertation. See, Anthony Low-Beer, "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources" (unpublished Ph.D. dissertation, Columbia University, New York, 1970), esp. p. 75 ff.

there is a real danger that such efforts would, ¹
in the end, delay effective SO₂ emission control.

The NAE concluded that several years of sustained support of research, development and demonstration would be required to bring "a variety of the more promising processes, as may be suited to specific local and regional conclusions. . .to full-scale operating efficiency at the earliest practical date."

The advantages of emission charges in reaching this objective have been recognized by the present Administration in its proposal for a "clean air emission charge" on the emissions of sulfur oxides. A recent Domestic Council document states:

With no technology currently available, industry does not have an incentive to invest in control equipment until it has been tested for some time. Enforcement at all levels of government is likely to be hampered by arguments on technical feasibility. An economic incentive would provide pressure for industry to demonstrate and use technology as soon as possible to avoid the charge. It would also provide an incentive to achieve even higher levels of abatement than required by the standards. As such, it will provide a powerful tool to help achieve the air quality standards called for by the Clean Air Act.²

Comparable incentive for innovation is not provided by any other approach.

1. National Academy of Engineering, National Research Council, "Abatement of Sulfur Oxide Emissions from Stationary Combustion Sources" (Washington, D. C., 1970), p. 3.

2. The Domestic Council, Executive Office of the President, The President's 1971 Environmental Program: Controlling Pollution (Book One) (Washington, D.C.: Government Printing Office, 1971), p. 2.

Evaluating on the Basis of Effectiveness and Economy

From the above analysis, we rate various approaches on the basis of the criteria of effectiveness and economy. Table 10-1 presents simple judgmental ratings of each approach, ranging from low (very bad) to medium (fair) to high (very good).¹ This evaluation represents a distillation of the discussion above and of detailed statements in the compendium.

Table 10-1

EVALUATION OF APPROACHES TO AIR POLLUTION CONTROL

Approach	<u>Criteria</u>	
	Effectiveness	Economy
1. Emission Standards	high	medium
2. Land Use Controls	low	low
3. Private Legal Action	low	low
4. Cost Sharing Measures	low	low
5. Economic Incentives	medium	medium
6. Emission Charges	high	high

Emission charges and emission standards both come out as superior or equal to the other approaches in both criteria.

1. No attempt was made to state these values numerically or to "total" the score of each approach. To do so would be unwarranted both because of the combined effect of both criteria is greater than the sum of each and, more fundamentally, because attaching numerical values to criteria would imply more specificity than can be justified. Quantitative measures are undoubtedly useful, but quantification of criteria should proceed only to the point where knowledge is sufficiently precise to support it.

Other evaluation techniques would be unlikely to change the major conclusions materially; emission charges and emission standards would still rank above other approaches to air pollution control. The economic incentives approach scores well only insofar as a tax on surrogates for emissions can approximate an emission charge system.

Considerations of Flexibility

In the real world, the pollution control problem changes constantly as to the amount and kind of pollution to be controlled--both in the short term (e.g., additional pollution due to peak production hours or seasonal variations) and in the long run (e.g., industrial expansion or new plant locations in the control area). Furthermore, it is possible that over time the public will demand higher quality ambient air, particularly as knowledge accumulates about the long-term damages associated with air pollution.

It is, therefore, desirable that air pollution control approaches be able to accommodate changing air pollution control conditions. At least four concrete cases can be distinguished here: adaptability as to geographic area, meteorological conditions, economic activity and long-term change.

1. Adaptability to Geographic Area. Thousands of industries and incinerators pollute in the area of New York City, while there may be only a handful in remote, small towns. Obviously, New York City requires more pollution control in order to attain the same ambient air quality as the small, remote town. An approach which does not differentiate according to such conditions will result in excessive costs in rural areas, and too little abatement (with resulting air pollution damages) in urban areas.

2. Adaptability to Meteorological Conditions.

Changing meteorological conditions require differing degrees of air pollution abatement in order to meet a given air quality standard most efficiently. The frequency and seriousness of inversions, for example, may be greater in summer than in winter. In such cases, more air pollution abatement may be needed in summer than in winter months. Approaches to air pollution control which do not differentiate according to changes in meteorological conditions are correspondingly inefficient.

3. Adaptability to Changes in Production. Many firms vary their production considerably, whether by hour of the day, day of the week, or season of the year. Weekend production in most plants, for example, is considerably less than during weekdays. Similarly, there are seasonal swings. For some industries, the periods of highest production coincide with the worst meteorological conditions, from an air pollution control point of view. For others, the opposite is true.

4. Adaptability to Long-Term Change. In the long run, all factors contributing to the need for air pollution control are subject to change. Some of the more obvious are population, industrial production and plant location, and technological change. These factors contribute to the air pollution control problem both for individual areas and for the nation as a whole. Furthermore, social views as to pollution control can be expected to evolve, particularly with a growing body of knowledge and research.

Too little is known at present about the characteristics of flexible approaches to warrant assessing the various approaches to air pollution by this criterion. However, as more is learned about applying different approaches, flexibility is certain to become increasingly important.¹ Furthermore, if approaches were evaluated

1. Flexible (as well as inflexible) controls need to be applied judiciously, as the following example illustrates. Sulfur oxides are one of the most serious and widespread of pollutants. During the past few years, much control legislation has been concerned with encouraging the use of low-sulfur fuels at all times. The increased

in terms of adaptability, the effect almost certainly would be to further downgrade land use controls, private legal action, cost sharing measures and economic incentives as major approaches.¹

At least in the past, emission standards have been set by state and local governments. This has permitted variation and hence some flexibility. The 1970 Amendments to the Clean Air Act, however, establish national emission standards for new plants--a shift away from regional differentiation which makes adaptability to geographic area almost impossible.²

In principle, emission charges could be raised or lowered in accordance with the geographic area, meteorological conditions, the time of day or season of the year and other factors outlined

demand for these fuels, however, has made it difficult to allocate the existing supply among all the new users. Indeed, widespread concern about the shortage of low-sulfur fuels, particularly natural gas, is now reflected in higher prices and has been the subject of several governmental studies. These studies warn that competition for low sulfur fuels will, before long, seriously outrun the available supply. A sensible, flexible approach to abating sulfur oxides would recognize that extensive use of a scarce resource is self-defeating in the long run. A very large proportion of natural gas could be saved if it were only used when ambient air quality was unsatisfactory. Measures designed to this end would encourage industry to install fuel converters so that they could switch fuels readily--a policy already adopted by a number of thermal electric power plants.

1. Land use controls, for example, are "once and for all" measures which cannot readily accommodate changing air pollution control conditions. Likewise, private legal action is cumbersome. For example, a private citizen could hardly obtain an injunction against a polluter during an inversion until the inversion had passed. Cost sharing and economic incentives suffer the same drawbacks.

2. Some adaptability to meteorological conditions would be encouraged under the amendments by the requirement that each state have an emergency plan for implementation at times of specific atmospheric conditions (e.g., the air pollution alerts established by the U.S. Meteorological Service).

above. More importantly, emission charges are probably easier to adjust than any other approach from the standpoint of both the pollution control agency and the polluter. For the former, the adjustment of charges would probably be a matter of administrative discretion. For the latter (and assuming the charges were adjusted upward), emission charges have the advantage of allowing the polluter to pay the additional charge during the transition period, instead of requiring him to control immediately, seek a variance or exemption, or shut down. These adjustments of emission charges, however, are constrained by the practical consideration that polluters must be able to respond thereto.¹

The adaptability of any emission charges approach is contingent upon the specific provisions of its enabling legislation. The sulfur oxides emission charge currently contemplated by the Administration appears not to be designed for adaptability to varying geographic conditions, or most other factors. Thus, unless the charge is intended primarily as a minimum for state and local control programs, rather than as a uniform national emission charge, the

1. At least one case can be identified in which variable charges would elicit a response--that of fossil-fueled electric power plants. According to the second Cost of Clean Air report, these sources account for 49% of sulfur oxides emissions. By the mid-70's, however, most of these plants will be able to respond almost automatically to changes in costs on an hour-by-hour basis. Thus, although air pollution emission charges are not considered in calculating whether or not to use low sulfur fuels at the present time, it would be very easy for power plants to accommodate hourly changing charges along with other variables. As ambient air conditions worsened in one area, power production would be shifted automatically to other areas which did not have the same problem.

effect may be to impose the same inflexibility that impairs the usefulness of national emission standards.

Considerations of Equity

Secondary Effects

Most public policies have secondary effects which benefit or damage various groups relative to alternative policies.¹ Air pollution control programs are no exception. A program involving a sharp reduction in coal-burning power plants, for example, could cause unemployment among coal miners. In this case, a geographically concentrated and politically powerful interest group might require compensation of the unemployed, economic development assistance to the area affected, or (most likely) another approach altogether.

No attempt has been made to evaluate approaches as to secondary effects. In principle, the economy criterion presumes that indirect, as well as direct, costs are taken into consideration; the effectiveness criterion makes the same presumption as to indirect (secondary) benefits. In fact, indirect effects are likely to be neglected unless they impinge on individuals who are both conscious of the impact and capable of articulating their approval or disapproval. At this point, secondary effects may become a subject for political analysis.

1. For example, the decision by government to produce fighter bombers will result in a different distribution of income-by-income level, occupational group and geographical area than a decision to produce nuclear submarines, because the composition of the work force and the location of plants are different in the two industries.

Few generalizations can be made as to the impact on specific groups of the respective approaches to air pollution control. In particular, the real incidence of costs for any approach is extremely complicated and often involves considerable uncertainty, as a recent study points out.¹

Considerations of equity arise in this context but have little practical consequence, because they cannot be answered with any certainty for policy questions such as: Who should pay for pollution control?

Equal Treatment of Polluters

Any analysis of approaches to air pollution control must recognize that fair treatment is central to success, a point emphasized

1. See Adrian J. B. Wood, J. Serge Taylor, Frederick R. Anderson, and Laurence I. Moss, "Strategies for Pollution Abatement" (unpublished staff study of the Committee on Public Engineering Policy, National Academy of Engineering, Washington, D.C., 1971), Chapter 2. Differing distribution effects can be identified depending upon whether uniform (e.g., across-the-board emission standards) or selective abatement is required and whether a pollution control program is national or regional in scope. These issues are not treated here. However, it should be noted that some of these questions have already been settled, at least in principle. By requiring national ambient air quality standards and providing for national performance standards for new stationary sources and national emission standards for hazardous air pollutants under the 1970 Amendments to the Clean Air Act, Congress appears to have opted for an approach to air pollution control which embodies uniform emission standards and is national in scope. At the same time, however, various cost sharing measures enacted by Congress imply that the Federal Government should share, if only in a limited way, in the costs to industry of air pollution control. Congress has also implied a limit on how much should be paid (by industry, government, consumers, etc.) for air pollution control by requiring consideration of technical and economic feasibility. Under the 1970 Clean Air Amendments, however, these considerations are secondary in importance to the protection of public health.

in Chapters 2 and 3. The objective of equal treatment of firms is a priori desirable. If it requires uniform standards applicable to all polluters, however, it may come into conflict with another objective: a lower aggregate cost of abatement, which might be achieved with selective controls.¹

Another difficult-to-resolve question has to do with burdens on different firms and industries of complying with air pollution controls. Introducing either uniform standards or emission charges will impose greatly different burdens relative to the status quo ante. It is not sufficient to dismiss the problem with the answer that the greatest offenders should bear the heaviest costs, for some costs may be socially intolerable, such as heavy unemployment in a particular area. In such situations, cost sharing measures may be needed to help equalize burdens. In this connection, it will be increasingly important to develop guidelines for granting such assistance as air pollution control programs evolve.

Equal Treatment of Those Damaged by Pollution

Reducing pollution confers different degrees of benefit, depending on the extent of damage which would otherwise accrue. Similarly, if only partial abatement is achieved, as by a standards or charges approach, some individuals may not obtain adequate relief.

1. It is useful to distinguish between (1) equal treatment of polluters by public agencies, (2) the provision of equal opportunities (in terms of the pollution control options available to emitters), and (3) equal results. Uniform emission standards, for example, may appear equitable according to the first meaning, but not according to the second two.

In such instances, still other approaches may be useful. Private legal action, for example, may afford relief in some circumstances.

Other Considerations

Five additional considerations should be identified, though it is not possible (on the basis of research done for this compendium) to use them for evaluating various approaches. They are: administrative costs, communicability, information requirements, political acceptability, and susceptibility to legal challenge. Together, they comprise many of the elements of "administrative feasibility." There is some value in considering them briefly here, both with respect to further research needs and in the interest of clarification of concepts. In particular, the following discussion throws doubt on some generally accepted propositions concerning the comparison between emission standards and emission charges as approaches to air pollution control.¹

Administrative Costs

Any attempt to calculate the costs of air pollution control should include both the costs of control at each source and the costs

1. We perhaps over-generalize in referring to "generally accepted propositions" in a public policy area as rapidly evolving as air pollution control. However, one finds threads of agreement on various points in the rapidly growing literature. Admittedly, the contrast between our findings and what we call generally accepted propositions has been sharpened in order to stress important points.

to government of administering the control program.¹ Measurements of administrative costs--particularly in ways which are useful for comparison among approaches--are difficult to come by, and some discussions of air pollution control have failed to take them into consideration. Administrative costs per se are small in comparison to total abatement costs.² But, administrative deficiencies (and particularly the lack of professional personnel) can be the most important impediment to the enforcement of any approach to air pollution control.

Suggestive of the problems is the controversy surrounding a recent Kentucky coal mine disaster (the Finley Brothers mine where 38 men were killed in December, 1970) and the failure of the Bureau of Mines to enforce fully the strong Federal Coal Mine and Safety Act of 1969. During the Bureau's first nine months of operation under the new law, according to a recent newspaper report, "its officials have come under continuous Congressional criticism" for "a persistent shortage of and failure to recruit the new mine inspectors required

1. For purposes here, manpower requirements are taken as a simple surrogate for administrative costs. Other administrative costs, could they be measured, might include the need for new administrative agencies, any requirements for extensive consultation and cooperation with other agencies and/or levels of government, and so forth. The information requirements for emission standards and emission charges (e.g., the need for inspections, monitoring equipment, etc.) are taken up separately below.

2. According to the first three reports to Congress on "the cost of clean air," administrative costs would amount to about 15 percent of the total costs of control. These are national estimates, all of them previous to the 1970 Clean Air Amendments and may have to be revised substantially in the light of actual experience.

for full safety inspections and enforcement in the nation's 2,800 underground mines. . ."

It has been charged that the shortage of inspectors--fewer than 500 of the required minimum of 750 to 1,000 are trained and deployable--was one cause of the Bureau's failure to reinspect the Finley Brothers mine on December 22 after citing it for safety violations on November 19 and setting a 33-day compliance deadline.¹

Such shortages of skilled personnel exist also in the federal enforcement effort for air pollution control. A recent study of federal enforcement points out that powers enabling the Federal Government to deal with potential sources of air pollution (e.g., a proposal to construct a large paper mill) have not been formally used, largely because of limited manpower and the urgency of dealing with existing pollution sources.² Even more significant is the limited administrative capability of state air pollution control agencies (see Chapter 1).

As air pollution control agencies at all levels of government adopt new control regulations involving a wider spectrum of sources and pollutants, and as they increase the scope of their enforcement action, more professional and other manpower will be required. Meeting such needs will require, in turn, training programs, more adequate salaries, and related measures. The identification of

1. Ben A. Franklin, "Discord Over Mine Safety Poses Coal Supply Peril," New York Times, January 10, 1971, p. 67.

2. J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 183.

major manpower bottlenecks and the development of programs to alleviate this problem should have high priority.¹

Second, as air pollution control programs evolve, more knowledge will be needed of the administrative costs of various approaches. It has been generally accepted that emission standards are easier to administer than a system based upon charges. But the opposite may be true--enforcement of emission standards against individual polluters may be less efficient as to use of time, money, and manpower and less effective as to results than enforcement of emission charges; present knowledge does not permit a solid answer.

Advocates of emission charges argue that the administration of this system would be simpler than for the standards approach since, at least in principle, the control agency would merely have to set ambient air standards, establish a schedule of charges for emitting given amounts of pollutants into the air, bill the polluters, and monitor compliance. Under the charges system, it is said, private firms, rather than government agencies, would bear much of the burden of investigation, decision-making and administration. Furthermore, it is held that industry, rather than government, is better able to evaluate the advantages and disadvantages of alternative control techniques and technologies.

1. A number of programs are underway at present to increase the supply of air pollution control personnel. These include federal recruitment and detail of personnel to state and local agencies, support for under-graduate training, post-graduate training for state and local agency employees, centralized job registers, and improvements in state and local agency salaries and merit system classifications. It is not known, however, whether these are adequate, particularly under the 1970 Clean Air Amendments.

On the other hand, doubts have been expressed about the availability or possibility of developing emission monitoring techniques adequate for effective enforcement. Especially when sources are numerous and emissions are small, it is argued, emission monitoring for a charges system would be extremely expensive. (Such arguments are considered below under "Information Requirements.") At the present time, however, little is known concerning the administrative costs of various approaches. But it should be noted that administrative advantages claimed for the standards approach over emission charges cannot be accepted on face value. More in-depth research will be required to resolve these and associated administrative questions.

Communicability

Effective administration of an approach necessitates that its provisions and requirements be readily communicated to all parties concerned.¹ First of all, it must be explained in terms that can easily be understood by legislators, members of regulatory commissions, agency administrators, and the public. No easy answer is available at this time as to the comparative communicability of the

1. Communicability, as seen from the standpoint of administrators, is only one way of framing this consideration, of course. From the standpoint of polluters and the public, an approach should be accessible to competing claimants of the air resource so that all may have a "day in court." In addition, the enabling legislation and the air pollution control agency should be structured so as to encourage a balancing of competing interests (e.g., the public's need for clean air, industry's need to operate efficiently, and the public need for having industry continue to operate) and a timely and equitable resolution of differences.

approaches examined in this compendium. The questions involved are complex, and much depends upon the specific provisions of the enabling legislation.¹ It seems generally to have been assumed that the emission standards approach accords with common sense and is easily comprehended by polluters and public alike. In fact, emission standards are often difficult to comprehend, particularly for non-technicians. Industry representatives have complained that standards are too numerous and conflicting and that they change too often for industry to plan and implement effective methods of compliance.² Standards vary widely among jurisdictions as to levels, durations, and frequencies.

1. The comment by a former consultant to the air pollution control agency in a major metropolitan area demonstrates how difficult it can be to communicate unfamiliar air pollution control procedures:

Air pollution implementation plans are an extremely complex combination of meteorology, engineering, law, statistics, economics (although not much, I regret), and so forth. In the public hearing for the air pollution implementation plans [for a major metropolitan area], we felt that few in attendance understood more than 20 to 30 percent of the material involved. Lawyers didn't understand the meteorologists, the systems analysts didn't understand the administrative problems, the allergists didn't understand the engineers, and so forth.

Information from Ken Woodcock, Office of Program Development, Office of Air Programs, Environmental Protection Agency, June, 1971.

2. There has already been experimentation with standards which include pounds of pollutants per hour, percentage of pollutants removed, percentage of pollutants in total smoke emitted and color of the smoke. See James MacGregor, "Companies Complain that Pollution Laws Conflict, Change Often," Wall Street Journal, December 23, 1970.

As for emission charges, it has been generally accepted that, while the public might approve the idea of an emission charge system, the actual setting of the charges involves technical decisions which would be difficult to understand. Lacking actual experience with emission charges, of course, one can only speculate about how a system of charges would work in practice. Yet, it is not clear why emission charges should be more difficult for the public to follow and understand than the present emission standards. Indeed, it is conceivable that emission charges (e.g., \$45 per ton of sulfur oxides emitted) would be more, not less, comprehensible to citizens than would be the existing emission standards (e.g., no plant using X fuel can discharge emissions containing more than Y parts per million of sulfur oxides in every Z hour[s]). Again, the answers to these questions must await further research.

Information Requirements

Information is an integral element of any approach to air pollution control. Data derived from atmospheric monitoring and emission measurements are required through various stages of the enforcement effort. It is necessary to identify the emitters and pollutants emitted to establish their concentrations and to record their time trends and patterns. Both ambient air and emission source monitoring are necessary for enforcement, to evaluate progress, and to activate emergency controls during episodes of extraordinary pollution.

The most important information requirement for evaluating most control measures and devising administrative procedures concerns emission source monitoring systems. Among the questions needing attention in this area are the following: What monitoring capabilities would be required by various approaches? What kinds of pollutants can be successfully measured, and over what periods of time? How should emission standards be set or emission charges imposed--on the basis of the volume, weight per hour, threshold values, etc. of particular pollutants as measured by monitors? Who will specify, install, calibrate, certify, and maintain emission source monitoring systems? Research into this area was not included in the present project as finally planned but is essential to further progress.

It has been generally accepted, however, that emission charges require more information--and hence more extensive monitoring--to administer than do emission standards. Thus, a major argument against the emission charges system is that the sources of air pollution are so numerous and reliable monitoring instruments are either unavailable or so expensive that the key step of monitoring all substantial emissions by individual plants is not possible with existing technology.

There is, however, little analysis or factual information to support this judgment. And it is not clear why emission monitoring required by a charge system need be more sophisticated than that required by a standards approach, since both require the capability of measuring emitted pollutant concentrations as a function of time. Elementary standards, of course, employ only crude measures;

violations involve exceeding allowable emission levels for short periods. But once standards become more sophisticated, and there are a number of pollutants to be identified and controlled, more complex monitoring is required by the standards approach.¹ It is possible, though we do not now know, that the information required for emissions charges can be supplied with little or no additional equipment or effort.

Political Acceptability

The political aspects of various control measures are outside the scope of this study, though they are essential, of course, for full evaluation. Here we may observe that pollution controls are involved, to a degree equaled by few other public policy questions, in the manifold aspects of American federalism and politics, Congress and the Executive Branch, state and local governments, interest groups and public opinion, and the rest. Both the proponents and the opponents of tighter controls fight in many arenas and seek to shift the contest to the arena, or governmental level, where they have the best chance of winning.

1. Eventually, emission monitoring of some sort will be required even for emission standards, as is apparently recognized in recent legislation which stipulates that the EPA Administrator may require polluters to monitor their own emissions.

Section 114(a)(1) of the Clean Air Act as amended states: "The Administrator may require the owner or operator of any emission source to (a) establish and maintain such records, (b) make such reports, (c) install, use, and maintain such monitoring equipment or methods, (d) sample such emissions. . . and (e) provide such other information as he may reasonably require."

For example, the coal and oil industries largely prefer state-local controls to federal controls, though some states go further than does the Federal Government. Conversely, state and local environmental groups have often urged federal action where particular states and localities show insufficient vigor in prosecuting polluters.¹ Any study of political acceptability must deal with these and other complexities, all of which make difficult the formulation of political strategies to obtain any desired result, or to predict the acceptability of any particular measure, in view of the pulling and hauling, and compromise, which usually attend the passage of any controversial measure (as any innovative air pollution control measure will certainly be). However, the recent legislative history of some pollution control measures provides at least some basis for a few preliminary statements.

The first and most important is that emission standards have already passed the initial hurdle of legislative enactment both in the United States Congress and in various state and local legislatures. At the same time, there is growing interest in emission charges as an approach to air pollution control. In his recent environmental message the President said, "A charge on sulfur emitted into the atmosphere would be a major step in applying the principle that the costs of pollution should be included in the price of the product." This, of course, is a direct reference to the concept of emission charges, and

1. Cited in J. Clarence Davies, III, The Politics of Pollution (New York: Pegasus, 1970), p. 143.

an indication of the fact that this approach is gaining support in Congress and elsewhere.

Growing interest in the charges approach is also indicated by the changes in Congressional attitude from coolness characteristic of the 1966 Hearings to the attention and positive interest shown in 1970 (see Appendix B).

Susceptibility to Legal Challenge

In comparing a system of emission charges with standards, it has been suggested that the legal status of the latter would be somewhat less open to question "simply because it is somewhat less of a novelty in the spectrum of public policies."¹ This judgment may be premature.

One reason for thinking so is that emission standards themselves present many legal problems (see Chapter 3). Furthermore, there is but limited experience with federal enforcement action. As of early 1971, only one case in water pollution and one in air pollution has been brought to court.

Concerning charges, the most important fact is that an emission charge system for air pollution control has yet to be tried, and appropriate analogies are lacking. Any observations on the susceptibility of emission charges to legal challenge are therefore necessarily conjectural. Here we indicate the major avenues of

1. George H. Hagevik, Decision-Making in Air Pollution Control (New York: Praeger, 1970), p. 378.

legal challenge and some of the more important considerations which need to be taken into account.¹

The enabling legislation for an emission charges approach must be worded with great care in order to minimize the possibilities of legal challenge at the enforcement stage. An emission charges approach does not fall easily into the usual legal classifications of a tax, a fine, a license, or a user charge. The choice of such a classification in the enabling legislation is extremely important, since it carries substantial implications, both as to the constitutionality of the approach and as to its subsequent ease of administration. A fine, for example, could be challenged on procedural due process grounds which would not be faced by a tax. Likewise, the exercise of police power (e.g., a fine) carries different constitutional and statutory limitations than that of an exercise of the taxing power (e.g., a tax). These and related questions have not been examined in this compendium; but if emission charges are contemplated, they should be a priority area for further research.

For any approach, two considerations are important in evaluating the susceptibility to legal challenge. First, the susceptibility of an approach will depend in large measure on the specific statutory provisions establishing the system. Second, the susceptibility of either standards or charges to legal challenge will probably

1. Adrian J. B. Wood, J. Serge Taylor, Frederick R. Anderson, and Laurence I. Moss, "Strategies for Pollution Abatement" (unpublished staff study of the Committee on Public Engineering Policy, National Academy of Engineering, Washington, D.C., 1971), pp. 4-26 to 4-45. This is the only detailed legal analysis of emission charges that has come to our attention.

hinge in some degree upon the accuracy and adequacy of emission-source monitoring. Some emission monitoring must be used in both the standards and the charges approach. Nevertheless, the legal challenges of vagueness (i.e., emission monitoring is insufficiently accurate to apply standards or charges) and equal protection (i.e., emission monitoring is so inaccurate that polluters are denied equal protection under the law) have not been used as yet against existing federal air and water pollution control acts.

Conclusions and Directions for the Future

The limited number of criteria which can be applied in the study have been useful in suggesting the two most promising approaches and identifying questions needing further investigation. We are particularly impressed by the need for more work on emission source monitoring and measurement, which must underlie most control systems and which are necessary for administering either emission standards or charges.

The same can be said for other considerations concerning the administrative feasibility of various approaches to air pollution control. At this time, these considerations cannot be usefully explored for lack of information and analysis. Very little is known compared with the field of water pollution control, where there have been decades of experience with effluent fees and where there has been considerable experience in the U.S. with enforcement of effluent standards.¹

1. In general, air pollution control poses more complex problems than water pollution control. The appropriate area for air pollution abatement is less well defined than the relevant area--the watershed--

The choice of approaches to air pollution control, and especially of inducing abatement by the private sector, faces conditions of imperfect knowledge, information and understanding, and inherent long-run uncertainties. Even with regard to the two major approaches-- emission standards and emission charges--questions abound as to comparative administrative costs, communicability, and information requirements; in short, questions of administrative feasibility. Faced with such uncertainty, the sensible way to proceed would be along several parallel paths. More than one single approach should be attempted so as to preserve as many options as possible until more information is available.

Emission standards are emerging as the dominant approach. Meanwhile, emission charges are scarcely being considered in most quarters, although the research for this report suggests that standards may be less effective, less economical, and less flexible to changing air pollution control conditions than charges.

The real question, however, is not which approach appears best in theory but which can actually achieve effective air pollution control most economically, subject to technological and institutional constraints suggested above. Again, it must be emphasized that the emission charges approach remains an untested idea. To the best of

for water pollution control. The benefits of air pollution control are also more variable by time of day, day of week, season of year, and weather conditions than those of water pollution control. Also, less is known about the chemical action of pollutants in the air than about those that enter the water. And finally, less is known about monitoring air pollution emissions than is known about metering the discharge of pollutants into the water.

our knowledge, no country has implemented or even carefully studied an emission charge approach to air pollution control. This suggests a strategy which seeks to obtain additional knowledge about emission charges by investing relatively small sums in additional research.

At present, little research is being done on the practical problems facing emission charges. This represents a very real research frontier. This country--and specifically the Environmental Protection Agency--could seize the opportunity by studying carefully and sympathetically the possibility of incorporating emission charges into the present system of air pollution control. The danger in not doing so is that there would be a tendency to delay for a long time the introduction of emission charges because of uncertainties, and then, when political pressures for action mount, to make large commitments to a program with no better knowledge base than before.¹ The danger would also lie in overselling the approach to the public and Congress before it is well tested for feasibility.²

1. The tendency of the Federal Government, in making policy on the environment, to alternate between spurts of creative energy and longer periods of deadlock and relative inaction has been documented in James L. Sundquist, Politics and Policy: The Eisenhower, Kennedy and Johnson Years (Washington, D.C.: The Brookings Institute, 1969), particularly pp. 322 ff.

2. In effect, this may have happened already with respect to the Administration's proposed emission charge on sulfur oxides. Last February the President proposed the charge and assigned the staff of the Department of the Treasury and the Council on Environmental Quality the task of developing the details of the program. The White House has proceeded to publicize this proposal, but Treasury and CEQ staff have found it difficult to develop the details of the plan, particularly given the absence of research on the application of an emission charges approach. Even with an intensive in-house effort, the proposed emission charge proposal is not expected to be presented to Congress until next fall.

Research should start from the premise that each of the two major approaches to air pollution control--emission standards and emission charges--has advantages and disadvantages. In all likelihood, no single approach is best for all situations. Furthermore, given the resources already committed to emission standards, this will probably continue to be the dominant approach, at least for the next five to ten years. Under the circumstances, research is needed on the appropriate role of each approach in an overall program of air pollution control. For example, it may be that emission charges are appropriate where it is particularly necessary to induce polluters to develop new techniques and technologies for pollution control. Emission standards, on the other hand, may be required for extremely toxic pollutants whose dangers, as to human health, demand prompt and vigorous action. Obviously, this "role differentiation" ought to be refined through additional investigation.

If research indicates that a charge system would be feasible, then the most effective way to resolve the remaining uncertainties may be to mount modest-scale demonstration programs with two main objectives: first, the alleviation of air pollution or specific elements thereof; second, the assembly of data for evaluating and improving administrative and other techniques. Data collection should be an integral part of the demonstration, not appended as an afterthought. In such a manner it will prove possible to resolve once and for all many of the questions which cannot be answered here.

Finally, it should be emphasized that neither the emissions standards approach nor the emissions charges approach precludes the

use of other approaches discussed in this report--land use controls, private legal action, and the use of cost sharing and other economic incentives. All these measures may play useful supplementary roles, though they cannot by themselves, either separately or all together, be relied on to control pollution.

In conclusion, an effective attack on pollution will doubtless require a blending of various approaches, each designed to complement the others. The optimal blending for specific conditions and specific areas, and the emphasis to be placed on each approach, should also be a high priority subject of further research.

APPENDIX A

MAJOR FEDERAL ENVIRONMENTAL LEGISLATION¹

Date Enacted	Air (42 U.S.C. 1857-18571)	Water (33 U.S.C. 466 et seq.)	Solid Waste (42 U.S.C. 3251-3259)
1948		Water Pollution Control Act. P.L. 80-845, 62 Stat. 1155	
1955	Air Pollution Control Research & Technical Assistance Act. P.L. 84-159, 69 Stat. 322		
1956		Water Pollution Control Act Amendments. P.L. 84-660, 70 Stat. 498	
1961		Federal Water Pollution Control Act Amendments. P.L. 87-88, 75 Stat. 204	
1963	Clean Air Act. P.L. 88-206, 77 Stat. 392		
1965	Motor Vehicle Air Pollution Control Act. P.L. 89-272, Title II, 79 Stat. 992	Water Quality Act. P.L. 89-234, 79 Stat. 903	Solid Waste Disposal Act. P.L. 89-272, Title III, 79 Stat. 992
1966	Clean Air Amendments. P.L. 89-675, 80 Stat. 954	Clean Water Restoration Act. P.L. 89-753, 80 Stat. 1246	
1967	Air Quality Act. P.L. 90-148, 81 Stat. 485		
1969	National Environmental Policy Act. P.L. 91-190, 83 Stat. 852		
1970	Environmental Quality Improvement Act. P.L. 91-224, 84 Stat. 91		
	Clean Air Amendments. P.L. 91-604 ²	Water Quality Improvement Act. P.L. 91-224, 84 Stat. 91	Resource Recovery Act. P.L. 91-512, 84 Stat. 1227

1. Other significant environmental laws include: Noise--Act to Require Aircraft Abatement Regulation, P.L. 90-411; Pesticides--Federal Insecticide, Fungicide and Rodenticide Act of 1947, 7 U.S.C. 135, as amended in 1959, 1961, and 1964.

2. Also include noise provisions. A chronological listing of all Federal legislation relating to air pollution control up to 1971 is contained in Section 1.1 of the Annotated Bibliography attached to this compendium.

APPENDIX B

EFFLUENT CHARGES AND THE U.S. CONGRESS¹

Consideration was first given to effluent charges in the U. S. Congress in response to the introduction by Senator Muskie in 1966 of Bill S. 2987. The bill was concerned primarily with the establishment of "river basin commissions" but included as well a provision for the possible use of effluent charges. In over 700 pages of recorded testimony, however, little attention was paid to this provision. What is more, it was apparent even from the limited testimony that few witnesses or legislators had a clear appreciation of the effluent charge approach. There was virtually no consideration, for example, of the demonstrated effectiveness of effluent charges as an inducement to private industry to undertake pollution control.

The testimony did reveal, however, a recurring objection to the effluent charge approach, which was criticized as constituting a "license to pollute." Although the exact nature of this criticism was not always clear, its thrust appeared to be either that the levels of effluent charges would be set unreasonably low, or that effluent charges were an unfair penalty which might drain the resources of industry, thus actually decreasing the effectiveness

1. The following appendix was prepared under the direction of project staff by Sheldon B. Kamins of the Georgetown University Law Center. As applied to air pollution control, the emission charges approach has been discussed in Chapter 8 of the compendium. As applied to water pollution control, an essentially similar approach--usually referred to as effluent charges--can be employed. The U.S. has no experience comparable to the effluent charge systems of Germany or France reviewed in Chapter 8. However, in recent years, two bills introduced into the Senate have suggested the implementation of an effluent approach by the Federal Government.

of regulatory procedures. In any event, only a handful of witnesses conceded that effluent charges might be reasonable, and then only as partial payment for central treatment facilities. Given the lack of support for effluent charges, and in the face of strong opposition, Senator Muskie and the Administration agreed to drop the provision for effluent charges.

In 1970 the tone of testimony was very different. Sensing that there might be something in the effluent charge approach, Senator Proxmire had introduced a national effluent charge bill¹ and strongly defended the effectiveness of his approach, both in and of itself and as a complement to existing direct regulation. He cited three cases in which effluent charges had been dramatically effective in decreasing pollution, and was followed by economists and lawyers who added support from both a theoretical and practical point of view. Furthermore, the Proxmire bill was supported enthusiastically by representatives from Vermont and Maryland, two states which had either enacted or were considering legislation for an effluent charge. Against this array of affirmative speakers, the opposition -- which by this time consisted of only a few representatives from private industry -- appeared ill-prepared and on the defensive.

The final crush of business in the 91st Congress did not allow complete consideration of the bill, although Senator Proxmire's office indicated he intends to reintroduce it in the coming session. Consequently, the future of an effluent charge approach--as embodied in the Proxmire proposal--is still uncertain, but it is clear

1. S. 3181, 91st Cong., 1st sess (1969).

that at this time Congress is giving much more serious and thoughtful consideration to this approach than it was just five years ago. To document this change in attitude, the Senate Hearings in 1966 and 1970 are treated in some detail below.

1966 Senate Hearings

Senator Edmund S. Muskie, presiding as chairman over hearings before the Senate Subcommittee on Air and Water Pollution (89th Congress, 2nd Session, 1966), introduced Bill S.2987, originally proposed by the Administration. In large measure the bill dealt with the concept of river basin planning, and the establishment of local "River basin Commissions" to act as planning agencies in the development of comprehensive pollution control and abatement plans.

In his opening comments, Senator Muskie indicated that the main problem in water pollution control was financial:

Last year the Congress enacted the Water Quality Act (of 1965). That legislation gave the Federal Government the means to set and to encourage water quality standards and to prevent as well as abate pollution. This was a major achievement. Now then, our task is to provide the necessary funds -- and it is a money problem -- to construct effective treatment plants and to improve our techniques for coping with pollution.¹

Though effluent charges were proposed in the bill, they were not defined; indeed the financing method was left to the discretion of each agency:

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st. Cong. 2nd Sess., p. 24.

The planning agency shall also, in preparing a comprehensive pollution control and abatement plan give consideration to effluent charges on public and private entities discharging wastes or raw or inadequately treated sewage into any waters within all or part of a river basin or group of related basins or parts thereof.¹

The proposal's vagueness suggested the low priority given it by the Administration (and by Senator Muskie himself). Although a number of economists (such as Allen V. Kneese) had at that time already written extensively about theory and practice of effluent charges,² no recognized authorities on effluent charges testified at the hearings. Consequently, the caliber of testimony on effluent charges was generally low. Indeed, in the more than 700 pages of testimony before the Committee, only a handful of witnesses even mentioned effluent charges, generally criticizing them as "licenses to pollute," an "administrative nightmare," or as a "negative approach to pollution abatement." The major advantages of emission charges--that they provide a strong inducement to reduce pollution--in the most economic manner--do not appear to have been considered by the witnesses. But a few agreed that it was fair for industry to help pay, through effluent charges, for the costs of central treatment facilities.

Response of Senators. Noting that the term was nowhere defined in the Bill, Senator Abraham Ribicoff summed up his understanding and opinion of the effluent charge provision:

1. S. 2987, 89th Cong., 2d sess. (sec. 104[b]) (1966).

2. Allen V. Kneese, The Economics of Regional Water Quality Management (Baltimore: The Johns Hopkins Press for Resources for the Future, 1964); O.C. Herfindahl and Allen V. Kneese, Quality of the Environment: An Economic Approach to Some Problems in Using Land, Water, and Air (Baltimore: The Johns Hopkins Press for Resources for the Future, 1965).

...[the] distinct impression is given that polluters can somehow be "charged" for the privilege of pollution. I am against this in principle and as a practical matter. Our guiding principle must be the prevention of pollution, not some financial arrangement whereby the polluter is penalized. As a practical matter he would probably be entitled to a "legitimate" business deduction when he filed his tax return. We must not, in this way, legitimize a practice we are trying to prevent.¹

The Senator from Connecticut went on to support a strict enforcement program coupled with "fast tax writeoffs" to industry for the installation of appropriate treatment facilities.² In response to Senator Ribicoff's comments, Senator Muskie stated: "[I] agree completely with your comments on the so-called effluent charge. The idea of the effluent charge appears to spring from the experience in the Ruhr Basin of Germany."² Yet the Senator went on to say that he believed that the effluent charge concept discussed in the United States was a misreading of the German experience. Later in the hearings he expressed his understanding of the Ruhr system:

The so-called effluent tax is supposed to be drawn from what is, I think, misunderstood as the Ruhr experience in Germany. As I understand that, following our visit there with Secretary Udall, the Ruhr system is not that at all.

The policy in the Ruhr is this: We are going to clean up every drop of effluent now discharged into our streams. We are going to make a charge against all polluters against their proportionate share for the cost of cleanup. To the extent that polluters will take care of their own pollution, to that extent will they be given a discount from the charge related to the cost of community facilities.

1. For a discussion of these measures, see the sections on accelerated depreciation and investment tax credits in Chapter 6.

2. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1966), 89th Cong., 2nd Sess., p. 37.

It is not an alternative. The waste dischargers are not given this choice: 'Well, you pay this tax and pollute, or clean up and not pay the tax.' It is not that kind of deal in the Ruhr, as I understand it.¹

Response of Municipalities. Mayor Ralph S. Locher of Cleveland, testifying on behalf of his city and on behalf of the U. S. Conference of Mayors and the National League of Cities associated himself with Senator Ribicoff's position, stating that it was wrong to charge for the "privilege of pollution" and that prevention of pollution -- not simply charging polluters -- should constitute the basic principle of the nation's efforts.² These comments reflected the most frequent objection -- that the effluent charge would merely constitute a license to pollute.³

Response of Industry. Speaking on behalf of the National Association of Manufacturers, David L. Gallagher failed to discuss his objections to the effluent charge proposal, simply categorizing it as a negative approach fraught with administrative difficulties. Gallagher also pointed out to the subcommittee that in response to a survey⁴ by the National Resources and Power Subcommittee of the

1. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1966), 89th Cong., 2nd Sess., p. 37.

2. Ibid., p. 157.

3. Ibid., p. 252, testimony of James Doherty, Legislative Representative of the AFL-CIO.

4. U. S. House of Representatives, Committee on Government Operations, View of the Governors on Tax Incentives and Effluent Charges (1966), 89th Cong., 2nd Sess., H. Rept. No. 1330, p. 17.

House Committee on Government Operations, 31 governors opposed the establishment of effluent charges by the Federal Government, eight governors expressed qualified approval and five governors questioned the idea and suggested that more study was needed.¹ Another spokesman of industry, F. E. Tucker of the National Steel Corporation and of the Iron and Steel Institute also cited the survey of governors and urged the subcommittee to oppose "punitive" effluent charge legislation.²

Two other spokesmen of industry, however, expressed slightly different views on the provision, views which seemed to reflect a somewhat deeper understanding and analysis of the effluent charge approach. Speaking on behalf of the American Paper Institute,³ William R. Adams, President of the St. Regis Paper Company, stated:

We vigorously oppose any theory of effluent taxation which assumes that government could levy charges on waste discharges that are not related to the cost of external treatment or the demonstrable value of stream quality. Such emphasis would be wrongly placed and would deal only indirectly with the prime objective or a positive pollution abatement program -- which is the improvement of water quality in our streams. The concept of effluent taxation recognizes little of the public interest in the abatement of pollution. On the other hand, service or user charges covering the cost of operation and maintenance of waste treatment facilities are quite different. Service charges can bear a meaningful relationship to both water quality

1. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution Control (1966), 89th Cong., 2nd Sess., p. 263.

2. Ibid., p. 309.

3. The Institute represents approximately 250 pulp and paper companies.

and waste quantity. And we believe that these charges are compatible with and necessary to the concept of joint waste treatment programs.

P. N. Gammelgard, director of the American Petroleum Institutes Committee for Air and Water Conservation and representing the Mid-Continent Oil and Gas Association, National Petroleum Refiners Association, Rocky Mountain Oil and Gas Association, and the Western Oil and Gas Association testified on behalf of these organizations:

If by an effluent charge is meant the equivalent of a sewer charge -- a fee for service paid to an agency providing waste treatment, there can be no objection. But we have serious reservations about this if it could be interpreted to mean a charge imposed against a plant according to the composition of its effluent. For one thing, we believe an equitable system for assessing such charges would be exceedingly difficult to devise. This obstacle alone would be enough to suggest that effluent charges of this type should not receive any endorsement.²

Gammelgard went on to side with those who felt that effluent charges would merely constitute a license to pollute and concluded his comments on the topic by referring to the rejection of the concept by the majority of the governors.

Response of Professional Groups. The text of the 1966 Senate hearings is devoid of any statements strongly in favor of the effluent charge concept. Several comments, however, may be categorized as

1. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution Control (1966), 89th Cong., 2nd Sess., p. 515.

2. Ibid., p. 309.

affirmative. Ralph Fuhrman, speaking for the Water Pollution Control Federation,¹ while expressing the familiar apprehension that effluent charges might constitute a license to pollute, also noted that if care were taken in setting the charges they would be an inducement to control pollution.

Samuel S. Baxter, president of the American Water Works Association² indicated that his organization had no objections to the concept, in theory, but submitted that considerable work would have to be done before effluent charges could be established on an equitable basis.

Disposition of Provision. The apparent absence of an adequate appreciation of effluent charges at the 1966 Senate hearings can probably be attributed to two factors. First, there was no comprehensible definition of effluent charge concept within the bill itself. Second, the provision dealing with effluent charges was discretionary in nature, and therefore not the subject of great attention. In addition, however, the support that might have been expected from the proponents of the bill and the administration was conspicuously absent. This lack of support was explained in a letter from the Secretary of the Interior, Steward Udall, written in response to an inquiry by Senator Muskie as to the meaning attached by the administration to the effluent charge provision.

1. The purpose of the Federation is to advance the fundamental and practical knowledge of all aspects of the control of water pollution.

2. A scientific and educational organization with a membership of more than 17,500.

Secretary Udall's response was as follows:

The language referred to would direct the planning agency to give consideration to "effluent charges". It implies neither endorsement nor rejection of effluent charges. Since S. 2987 was drafted, a Presidential Mission to the Federal Republic of Germany on Environmental Problems has had an opportunity to learn about effluent charges in the Ruhr-Emscher river valleys of Germany -- where the system had been reported to be operational. The whole concept is one which we thought was worthwhile exploring to determine if it is workable in a particular river basin. We view the idea not as a license to pollute, but as a system of charges to pay the cost of cleaning up pollution.

On the basis of these first-hand observations, we have no objection to deletion of subsection (b) section 104 of S. 2987.¹

It was clear from the Secretary's response that the Department of Interior had neither defined effluent charges nor attached much importance to them. Accordingly, and in light of the strong opposition to the proposal, it was not surprising that the effluent charge provision was deleted from the proposed legislation which reached the floor of the Senate.

1970 Senate Hearings

In contrast to the cursory consideration given to effluent charges in the 1966 Senate hearings, extensive analysis of the concept was presented to the Subcommittee on Air and Water Pollution during the 1970 legislative session² as a result of a bill proposed

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution Control (1966), 89th Cong., 2nd Sess., p. 138(a).

2. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 187.

by Senator Proxmire and co-sponsored by nine other senators.¹

Still before the Subcommittee as Congress adjourned for the 1970 elections, the Proxmire bill provides for the imposition of national effluent charges upon industrial polluters. The bill would leave the level of charges to be set by the Secretary of the Treasury who "shall consider the relationship between the quantity and quality of the waste discharged and the resulting damage to the quality of the waterway as the base for specific charges." The bill further provides that the revenue collected from the charges is to be distributed equally between municipalities on the one hand and regional water management associations on the other, "for the construction of waste treatment facilities."

Effectiveness of Charges. Senator Proxmire led off the testimony by making it clear that his proposal was designed to supplement the existing approach to pollution control, not to supplant it.² The Senator went on to argue the merits of effluent charges:

The effluent charge approach has the virtue of simplicity -- the less you pollute, the less you pay. It has the virtue of fairness -- all industrial polluters will be covered, and the cost of waste disposal will be regarded as what it should be -- a legitimate cost of production. But most important of all, effluent charges have the virtue of effectiveness -- they work.³

1. Senators Cannon, Case, Damerick, Hart, McGovern, Mansfield, Nelson, Pell and Young. Senate Bill 3181.

2. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 187.

3. Ibid., p. 188. (Emphasis added.)

The Senator cited three examples to support his contention that effluent charges were effective. The first example¹ concerned a single major industrial operation in Otsego, Michigan. Because the operation exceeded by threefold the waste levels which it had agreed to, the municipality charged the firm for all costs associated with waste treatment of discharges above the agreed-to levels. After only three months of the charge, the firm's total pollution had returned to the agreed-to level. Proxmire's second example² referred to a similarly successful experience in Springfield, Missouri. His third concerned the experience of the Ruhr Valley of Germany. The senator discussed the Ruhr experience with enthusiasm, concluding:

No one expects the Ruhr to be perfectly clean. The concentration of industry prohibits this. The system of effluent charges, however, has provided a level of water quality much higher than that found in major industrial rivers in the United States.³

Complementarity with Existing Approach. As a second major advantage of his proposal, Proxmire maintained that effluent charges would dovetail smoothly, indeed complement, the existing approach to pollution control. He noted that present law has three components -- standard-setting, grants, and enforcement -- and went on to say:

1. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 187.

2. Ibid., p. 189.

3. Ibid. The Ruhr Valley scheme is considered extensively in Chapter 8.

Effluent charges can play a key role in this procedure. The uses and criteria that are established under the standard-setting procedure would provide the goal against which pollution abatement performance is measured. The charge level will be such as to cause at least the attainment of water quality standards.

As the incentive generated by the effluent charge becomes operative, industry would take steps to reduce its pollution, and the standards could be tightened.

The eventual goal is a society in which industry would develop the technology to 'loop the system,' and effluents, with their attendant charges, would be virtually eliminated.¹

Continuing with his statement the Senator submitted that there need not be any concern that effluent charges would constitute a license to pollute and that industrial polluters would simply pay the charge and continue polluting just as before. He stated that:

The clear and unambiguous intent of S. 3181 is that the effluent charges be set high enough so that it will be less expensive for industry to treat its wastes and control its discharges than to pay the effluent charge. And no business is going to continue paying a high fee when it can take action to cut its costs.²

Insuring Compliance. On further discussing the level of charges to be set, the Senator suggested that to insure compliance it would be necessary that regulations be drawn up by the Secretary of the Treasury which would require full and complete reporting of discharges. The Senator also suggested that stiff penalties be

1. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 191.

2. Ibid., p. 192.

imposed for failure to report, similar to the way in which the Internal Revenue code is now administered.¹ In response to a question by Senator Muskie, Senator Proxmire agreed that the charge should bear some relation to the cost of treatment and that it also contain a punitive element to provide an adequate inducement. At this point, Senator Proxmire referred to the view of a recognized authority in the field, that a charge of 10 cents per pound² would somewhat exceed the treatment cost and provide some inducement to industry.³ However, the Senator reiterated that it was not the intention of his bill to set the charge but to direct the Secretary of the Treasury to do so. Proxmire would have the charge set by the Secretary on the basis of the "cost of treatment" plus an added charge to provide an additional inducement to industry.⁴

Effect on Small Business. Senator Proxmire concluded his testimony by responding to a question from Senator Baker as to whether the effluent charge approach would inherently discriminate against small business. This possible discrimination was a concern,

1. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 193.

2. Per pound of biochemical oxygen demand (BOD). The authority referred to was Dr. Allen V. Kneese of Resources for the Future, author of a number of works on water pollution control, including The Economics of Regional Water Quality Management (Baltimore, Md.: The Johns Hopkins Press, 1964).

3. Ibid., p. 195.

4. U. S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 196.

said Senator Baker, since "very large conglomerate-type companies" had "a whole range of products" and thus could afford to pay the charge more easily than a small producer. In response, Senator Proxmire stated that he did not feel the charge would discriminate in favor of large industry because the tax would be imposed on all makers of the produce and that the only discrimination involved was by virtue of a large industry's price leadership or monopolistic position, enabling it to pass on the costs more easily to the consumer. The colloquy between the two Senators ended with an agreement that it would be advantageous to bring market forces to work on the pollution problem, but Senator Baker expressed the reservation that this approach should take into consideration any special difficulties that might be created for small firms.¹

Legal Opinion. Orlando E. Delogu, Associate Professor of Law, University of Maine School of Law, summarized the effluent charge approach and offered his opinion as to the benefits which could be expected:

A number of benefits would result from implementation of a system of effluent charges. The most important and the central aspect of the modified system of effluent charges proposed is that once the water quality standard for a particular body of water is established by the legislature--once a commitment, if you will, is made to the public concerning the quality of water in a particular watercourse--a means of achieving and maintaining that quality of water can be automatically set in motion. The charges would begin immediately upon classification, or as soon thereafter

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 198.

as it is determined that there is an amount of effluent in a particular receiving water body in excess of the dilution capacity of that water body which if not treated would reduce the quality of water in that water body below the standard inherent in the classification. The charges would be divided on a pro rata basis among those economic units whose waste discharges into the particular receiving water body contributed to the previously mentioned excess. The charges would be limited in total amount to a sum (and that sum would be earmarked in advance) sufficient to build and maintain those treatment facilities which in each particular receiving water body are necessary to achieve the quality of water inherent in the legislatively established classification for that particular water body.

Market distortions and the misallocation or less productive use of resources occasioned by the ability of some economic units to shift their costs of waste disposal onto the state or other economic units would be corrected to the extent that the effluent charge system causes economic units to bear a large share of the cost of their own waste disposal.

Two different types of incentives would arise. Economic units passing effluent into the state's waters and incurring a charge would scrutinize their waste disposal program carefully and make any technological change which would reduce that charge by an amount greater than the cost of the change. Furthermore, in the long run, there will be a locational incentive. Economic units which need water but are not particularly concerned with quality and economic units whose discharge of effluent is large will tend to locate in those stream basins with low water quality standards. Here the state is still willing to absorb part of their waste disposal cost. On the other hand, economic units which require high quality water or whose effluent load is small will be attracted to stream basins having a high water quality standard.

All of the tools sought to be used are familiar. Congress may and has established research, investigative and enforcement mechanisms to deal with water pollution. These are not replaced but simply

augmented. The effluent charge proposal combines Congress' power to tax privileges with the long used municipal waste load surcharge concept (although on a slightly larger scale) to provide an effective enforcement mechanism to enable achievement of the water quality standards inherent in stream classifications; and the public erection of sewage treatment facilities is by no means new.

In summary Congress seems uniquely able at this point to innovate in the area of water pollution control by effectively combining the tools of the economist, planner, water resources engineer, and state government. However, the focus has not been on the details of implementing the proposals made. This task, of course, will have to be undertaken and will present some difficult administrative challenges once the broad concept of enforcing stream standards by use of effluent charges (charges which are measured by and allocated to the construction costs of needed waste treatment facilities) has been accepted.

The idea of enforcing water quality standards by imposing an effluent charge should be considered seriously and critically. It cannot simply be rejected out of hand, for it, or some variation of it, must be made to work if the economy and general welfare of our nation are to continue to move ahead. We have already deceived ourselves in the area of pollution control and abatement far too long.¹

Response of Economists. The views of the two economists testifying before the committee seem to accord with the statements of Senator Proxmire and Professor Delogu. Excerpts from the testimony of Edwin Mills, Professor of Economics, Johns Hopkins University, reflect this concurrence:

The use of market incentives to mobilize scarce resources and to ration demand is one of man's remarkable inventions.... The fundamental pollution

1. U.S., Congress, Senate, Subcommittee on Air and Water Pollution, Hearings, 91st Cong., 2nd Sess., 1970, p. 226.

problem is that producers of wastes discharge them into the environment without taking account of the costs that environmental deterioration imposes on other users of the environment. This leads to two distinct kinds of resource misallocation. First, too little material is recycled in the productive process, i.e. too much material is withdrawn from and discharged into the environment. Second, discharges are in forms and at times and places that excessively impair the use of the environment.

...pollution results from an extremely large number of resource allocation decisions, and these decisions are best made through markets rather than through judicial and quasi-judicial processes. Pollution is strongly affected by decisions regarding product and process design, plant location and modernization, as well as by decisions specifically about waste disposal and treatment. These decisions are and should be made mainly on the basis of market considerations.

....Economists have two strong objections to subsidy proposals. First, with some exceptions, expenditures for pollution control do not yield revenues or profits. Thus, subsidies merely reduce the losses on unprofitable expenditures. But they are still unprofitable. Therefore subsidies provide almost no incentive for expenditure on pollution control equipment. Second, subsidies are feasible only for conventional treatment equipment. But, often the most economical way of abating waste discharges is through process and product changes rather than through treatment. Subsidies therefore bias the response in an uneconomical direction.

....Since effluent fees are charged according to the amount and strength of the discharges, the amount of the fee falls regardless of the technique of abatement and the response is therefore not biased. Most important, an effluent fee brings market considerations into every managerial decision that directly or indirectly affects polluting discharges. Waste producers will have an incentive to seek ways of abating discharges in every decision so long as any waste is being discharged.¹

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 367.

Professor Mills, however, did make one substantial suggestion for modifying the Proxmire bill: that it apply to municipalities as well as industry because municipal plants are run inefficiently and would likewise benefit from an economic incentive.¹ He also suggested that provision should be made for temporary exemption on a hardship basis for both municipalities and industry. He emphasized, however, that the exemption should be temporary and that a schedule for compliance should be spelled out as to the time period over which the fees would have to be paid.²

Professor Mills also cited a potential advantage of the effluent charge approach from the perspective of private industry: that under existing enforcement procedures, Federal officials were frequently obliged to interfere in decisions which ought to be the prerogative of management. Conceding that the effluent proposal would not eliminate the problem completely, he contended that effluent charges would nonetheless reduce the interference of government.³

In addressing the problem of how to set the appropriate charge, Professor Mills suggested that further study would be needed before the "right" numbers could be ascertained, and that this would probably not come until some experience was achieved. The cost-benefit analyses needed would take some work, he felt, but this

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 368.

2. Ibid., p. 371.

3. Ibid., p. 374.

could be done with a degree of accuracy comparable to the calculations made for other public policies.¹

Perhaps the leading economist in the field, Allen V. Kneese, summarized his opinion on the subject of effluent charges in testimony before the Subcommittee on Conservation and National Resources of the Committee on Government Operations of the U.S. House of Representatives, February 6, 1970. The testimony was included in the record of the Water Pollution hearings at the request of Senator Muskie, and is excerpted here in part:

First, the system of effluent charges is based on the concept that efficiency and equity require payment for the use of valuable resources whether they happen to be privately or collectively owned. These prices will be reflected in the industrial producers' decision to install treatment equipment and otherwise reduce the generations of residuals. They will also be reflected in the price of intermediate and final goods so that a broader incentive will be provided to shift to goods with a lesser environmental cost.

Second, subsidies for treatment plant construction do not, by themselves, provide an incentive to take action to control waste discharges. Even if an industry is paid a major proportion of the cost of waste treatment plant construction, it is still cheaper, from the point of view of the industry, to dump untreated waste into the river. Thus the subsidy arrangement cannot work unless accompanied by enforcement or other pressures on the waste discharger.

Third, to the extent that the subsidy system works it tends to bias the choice of techniques in an inefficient direction. It would provide an incentive to construct treatment plants with federal subsidy even though internal controls would be cheaper.

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 373.

Finally, the effluent charges system yields revenue rather than further straining and eroding an already seriously overextended tax system. This revenue can be put to useful public purposes including improvements in the quality of our environment. From an economic point of view perhaps the best imaginable tax base is an activity that causes external diseconomies. Not only does a tax on such a base yield revenue, but it tends to improve the overall allocation of resources.

Most economists who have studied the matter have concluded that there are compelling reasons for favoring the effluent charges system as one of the cornerstones of effective and efficient regional water quality management. But it may be difficult for particular States and regions to pioneer such a substantial departure from previous practice. The federal government's greater insulation from powerful local interests provide an opportunity for leadership...¹

In a statement² strongly favoring the concept of effluent charges, Henry D. Jacoby, of Harvard University John F. Kennedy School of Government, expressed his opinion as to the limitations and problems involved in implementation of effluent charges. The Professor noted that because water quality is a complicated phenomenon, there is no reliable way to reduce a mix of waste substances to a single index of pollution. Yet, he went on to say, a system of separate charges on each different substance would be extremely hard to manage; because of this complexity, the charge system should be limited to two or three substances or simple indications of waste content, such as BOD.

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 399.

Given that only a small number of phenomena could be considered in any charge formula, such schemes would have to be tailored to the local situation if they were to be effective and efficient. It would not have been reasonable to establish a single, national water quality standard; by the same token, flexibility is needed in the planning of charge schemes in order to account for differences in conditions among regions, and to allow for variation in circumstances up and down any particular water body. This is why, where possible, there would be considerable advantage in having the detailed administration of the scheme in the hands of regional authorities who are most likely to have knowledge of local conditions, problems, and needs.¹

Professor Jacoby also favored imposing the charge on municipalities but

...recognizing the difficulty of imposing a charge on municipalities, it would be important to insure that industries within municipal systems did not evade such a charge altogether. In the design of a set of charges for a region or water basin, care would have to be taken to insure effective coordination between the regional charge and the service charges being levied by municipalities. The coordination problem does not seem insuperable, but much work remains to be done on this question and on other aspects of the relation between a national charge scheme and the existing pattern of physical facilities, local and regional institutions, and the provisions of current legislation.²

Professor Jacoby concluded his statement by commenting on the problem of the administrative costs associated with effluent charges:

A charge scheme would naturally involve administrative costs. Expenditure on sampling and surveillance would be considerable, but not fundamentally different from the requirements of current procedures. The calculation

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 491.

2. Ibid.

and collection of the tax presumably could incorporate some element of self-reporting, with provisions to discourage cheating and inaccurate measurement. There are municipalities who can contribute considerable experience with this type of charge. Of course, the design and coordination of a national program would require special study.¹

Response of States. Also speaking affirmatively on the effluent charge approach were representatives from two states. On behalf of the State of Vermont, State Attorney General James M. Jeffords enthusiastically endorsed effluent charges as an economically sound and realistic approach to the problem of water quality management.² He also went on to record in support of Senator Proxmire's statement,³ cited above. In support of the effluent charge approach, Mr. Jeffords noted that "without any legal right to do so", certain parties had "expropriated" a valuable natural resource "without paying a cent for it." He went on to state:

Two solutions become readily apparent in this circumstance. The first is to require immediate cessation of the discharge of degrading wastes and thus terminate this expropriation. Opponents of this solution correctly point out that the effect of such a course of action would be disastrous to our socio-economic system.

The second solution is to require such persons to pay for such expropriation or at least for the damage caused by their discharge of degrading wastes. This has the advantages of making waste disposal a cost

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 492.

2. Ibid., p. 347. See also the section on the Vermont effluent charge, discussed in an earlier section of this chapter.

3. Ibid., p. 348.

of doing business and brings into play the economic forces of the marketplace.

Opponents of this solution argue that this, in effect, legalizes pollution so long as one can pay for the right to do it. Initially persuasive as this argument may be, is it valid when viewed in the light of the fact that we seem to have already accorded an illusory right to certain persons to degrade waters which right we cannot immediately revoke because of the consequences of our socioeconomic system? If economics dictate that we cannot immediately call a halt to water quality degradation, it seems only fair and just that we use economics as a means of regulating such degradation.¹

In an attempt to combat the pollution problem in Vermont, Attorney General Jeffords indicated that the State legislature had enacted bill S. 165, which embodies an approach similar to that proposed in Senator Proxmire's bill, S. 3181.² In comparing the dimensions of the two bills and the consequences likely to flow from enactment of S. 3181, Jeffords went on to state:

A careful analysis of S. 3181 [the Proxmire bill] and S. 165 [the Vermont legislation] disclosed that though the economic concept is the same, the goals to be achieved by each are different. Note, for instance, that S. 3181 is not related to any standard of water quality and would impose the effluent charge on any discharge which degrades.

S. 165, on the other hand, would impose the charge only if the discharge would reduce the receiving water quality below the established classification. The difference here is in the nature of the incentive created by the charge. Under S. 3181 the charge continues so long as the discharge is at all degrading, thus providing a continuous economic incentive to reduce volume and degrading strength of the waste.

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 492.

2. See "Vermont Legislation" in Chapter 8.

Under S. 165 the incentive is only to reduce degrading quantity and quality during the time it takes to meet the water quality requirements of the established classification. S. 3181 operates independently of any classification or water quality management scheme and is truly a pay to pollute approach unfair as that term may be.

S. 165, our bill, is woven into and dependent upon a classification system of water quality management and actually represents a pay-while-you-clean-up approach. One radical difference between the two is that our bill applies to municipal wastes whereas S. 3181 expressly excepts the same. Our experience is that some municipalities need as much prodding as industries.

Although I support the concept of S. 3181, I would raise a question as to ability of the Federal Government to administer such a program. It would appear that any effluent charge system is dependent on a permit system to begin with. If I am correct in this regard, is the Federal Government prepared to establish and administer with or without help from the States a complete permit system for all discharges over which it has jurisdiction?

We would suggest that if the concept of S. 3181 is adopted, it should be done in a way to take advantage of present State administrative machinery. It might also be possible to devise an incentive program, such as a revenue-sharing approach, to make it financially inviting for States to adopt such charges.

However, we do see S. 3181 as a possible tool in an area which concerns us deeply. As mentioned earlier, we would like to move more fully into the effluent charge area. But if we do so alone, we may well place ourselves out of the market for new industry. Further, existing old industries may leave. same problem applies to any State which adopts an effluent charge theory or strict water quality standards.¹

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 350.

Representing the State of Maryland, Governor Marvin Mandel told the subcommittee that he has proposed a comprehensive pollution control plan to the state legislature and that an effluent charge was built into the plan.¹

Governor Mandel explained the provision in his pollution control plan as follows:

Once we acquire or build a plant, we then charge the users for the building, the acquisition and use of that plant, and it is based on three elements: The volume of waste, the strength of the discharge, and the treatability of the discharge...

Thereby, we encourage the industrial plants to lessen the pollutant that they put into the plant because the less pollutant, the less they pay.

We are, in effect, saying to them, "We encourage you not to use the plant but if you do, you are going to pay according to the amount of waste you produce, the strength of what you put into it, and how we have to treat it."

Response of Industry. Testifying against the concept of effluent charges were representatives of two industry organizations² which had also testified at the 1966 Water Pollution Control hearings. The position of both organizations on effluent charges had not changed significantly from those expressed at the session four years earlier. Neither industry organization representative, however, attempted to refute the previous testimony on the advantages of the effluent charge approach. Appearing on behalf of the National Association of manufacturers, Donald R. Tabot stated:

1. Ibid., p. 206.

2. National Association of Manufacturers and the American Petroleum Institute.

We are opposed to effluent taxes... . It is quite apparent that in order to impose effluent taxes it would become almost an administrative nightmare to try to do this job properly... . If we are going to have effluent taxes they should be uniform across the board.

The municipalities, which contribute 40 percent of all pollution should be subject to them as well as industry which contributes 20 percent of pollution. Can you put yourself in the position of a municipality, which every time there is a major storm where the sewage bypasses the treatment plant because it cannot handle the capacity, is going to be subject to an effluent tax?

So how do you measure this? What kind of an enforcement body do you set up? ...

It is a way for someone to pay to avoid investment in the pollution abatement equipment if he has the resources to pay. If the profit margin is large enough and he can afford the effluent tax, he has a way out, he can pay the effluent tax as opposed to doing what we really want to do. And that is to up grade our streams; that is, to make sure that they are not polluted.

The only way to do that is to install equipment that follows out our objective, not to pay an effluent tax and pull the strings.¹

Peter N. Gammelgard of the American Petroleum Institute devoted a portion of his statement to the effluent charge approach as incorporated in S. 3181:

It is difficult to see how negative incentives, such as effluent charges, can possibly serve the cause of clean waters. If the charges are paid they become no more than a fee for a license to pollute.

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970), 91st Cong., 2nd Sess., p. 350.

In our view, if water pollution control regulations are well conceived and are administered fairly, there is no excuse for failure to comply with them.

The payment of user fees by industrial plants that make use of municipal waste treatment facilities is a different matter. This is entirely reasonable, although the fees charged of industry should reflect the contribution industry makes to the support of municipal waste treatments works through State and local taxes.

Thus, Gammelgard rejected the imposition of any "punitive element" to the effluent charge, an element which the proponents of the concept felt was essential if the system was to be effectual.

Unanswered Questions. That many questions regarding the effluent charge approach were still unanswered was reflected in the testimony of the Honorable Kenneth Curtis, Governor of Maine, in a series of questions he submitted to the subcommittee for their consideration:

First, do effluent taxes constitute a license to pollute? If they are set too low, they clearly do -- so the rest of my questions assume that any effluent tax would be set high enough to actually deter pollution.

Second, would a system of effluent taxes, substituted for or superimposed on our present water quality legislation, add to the delay and confusion caused by past changes in our program structure? In this context, would industrial and municipal dischargers be paying the same dollars under the effluent tax that they might otherwise be spending on pollution abatement facilities? Under S. 3181, would money that industries had earmarked for their own cleanup purposes be taken by the effluent tax and given to municipalities, or in some cases, to joint treatment plants? If so, what about those industries who, because of isolated location or unsuitable waste, simply cannot discharge through a municipal facility? Should funds be taken from them to pay for facilities which they cannot use?

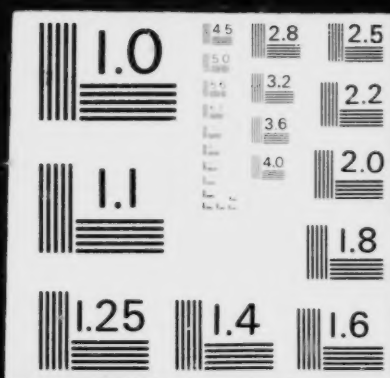
Third, if we can determine and monitor tolerable discharge levels with sufficient exactitude to establish effective effluent taxes, would we be better off using those calculations to establish a rigid enforcement system which would prohibit, rather than tax, the intolerable discharge. At any rate, we should never permit the ineffectiveness of past State and Federal enforcement officials to force us to abandon the present system, particularly at a time when increased public awareness promises to act as a prod to those officials whose efforts have been so ineffective in the past.

Lastly, is it possible that effluent taxes, planned to take effect following the expiration of present timetables, may be the most useful employment of this device? Under this approach, there would be no dislocation of present State plans, but industries and municipalities would be on notice that failure to comply with present State timetables would result in sharply increased costs when those timetables expire.¹

The final press of business at the end of the 91st Congress did not allow complete consideration of the bill. But since Senator Proxmire intends to reintroduce it in the coming session, it seems certain that the effluent charge approach will be given increasingly serious and thoughtful consideration by the legislature.

1. U.S. Senate, Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, Water Pollution (1970) 91st Cong., 2nd Sess., p. 541.

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Although the annotated publications presented in this chapter are largely self-explanatory, some limitations may be noted. The materials were prepared in accordance with the terms of reference drawn up for the Compendium and therefore concentrate principally on Federal approaches to the control of air pollution. A review of the major literature on state and local control programs is included. Relevant materials were also reviewed from other areas of environmental control. However, a systematic search of the literature of state and local programs, and of the literature relating to other forms of pollution would necessarily have extended far beyond the prescribed purpose of this study. The items listed have been selected with an emphasis on the period from 1967 to the present, although some older entries have been included where the publications referred to are considered to be of particular importance. The listing of foreign control programs relies heavily on the admirably comprehensive documentation provided by the Air Pollution Technical Information Center in APCO's Office of Technical Information and Publications.

The materials included in this annotated bibliography were all reviewed by project staff in the course of compiling this compendium. Xenia Duisin, Librarian of the Institute of Public Administration, was responsible for the technical preparation of the bibliography, assisted by Linda Allen and Larry Bernstein. The typing was carried out by Mrs. Mary Pierce and Miss Betty Geenty.

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1. FEDERAL LEGISLATIVE FRAMEWORK

1.1 Federal Legislation (Chronological)

1. Air Pollution Control. Public Law 159. July 14, 1955. (69 Stat. 322)

An Act to provide for research and technical assistance relating to air pollution control. No enforcement provisions provided.

2. Supplemental Appropriation Act, 1956. Public Law 219. August 4, 1955. (69 Stat. 450)

Appropriations for Sanitary Engineering Activities as provided in PL 159, p. 462.

3. Interstate Sanitation Commission. Studies of Air Pollution. Public Law 946. August 3, 1956. (70 Stat. 966)

Joint Resolution granting the consent of Congress to the States of New York, New Jersey and Connecticut to confer additional powers upon the Interstate Sanitation Commission.

4. Air Pollution Control Act, 1959. Public Law 86-365. September 22, 1959. (73 Stat. 646)

An Act to extend the duration of the federal air pollution control law and for other purposes.

5. Exhausts of Motor Vehicles Study. Public Law 86-493. June 8, 1960. (74 Stat. 162)

An Act to authorize and direct the Surgeon General to make a study and report to Congress, from the standpoint of public health, of the discharge of substances into the atmosphere from the exhausts of motor vehicles.

6. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1962. Public Law 87-290. September 22, 1961. (75 Stat. 589)

Air pollution p. 600.

7. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1963. Public Law 87-582.

Air pollution p. 371.

8. Air Pollution Control Act. Public Law 87-761. October 9, 1962. (76 Stat. 760)

An Act to amend the Act of July 14, 1955, relative to air pollution control, to authorize appropriations for an additional two-year period, and for other purposes.

9. Clean Air Act. Public Law 88-206. December 17, 1963. (77 Stat. 392)

An Act to improve, strengthen and accelerate programs for the prevention and abatement of air pollution. Enforcement provisions consisting of the hearings-conference-court procedure for interstate air pollution. Permanent authority. Grants authorized to state and local control agencies.

10. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1965. Public Law 88-605. September 19, 1964. (78 Stat. 959)

Air pollution p. 970.

11. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1966. Public Law 89-156. August 31, 1965. (79 Stat. 589)

Air pollution p. 600.

12. Clean Air Act, Amendment. Public Law 89-272. October 30, 1965. (79 Stat. 992)

An Act to amend the Clean Air Act to require standards for controlling the emission of pollutants from certain motor vehicles. Enforcement provisions for federal regulation of emissions from new automobiles.

13. Clean Air Act, Amendments of 1966. Public Law 89-675. October 15, 1966. (80 Stat. 954)

An Act to amend the Clean Air Act so as to authorize grants to air pollution control agencies for maintenance of air pollution control programs.

14. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1967. Public Law 89-787. November 7, 1966. (80 Stat. 1387)

Air pollution p. 1391.

15. Second Supplemental Appropriation Act, 1967. Public Law 90-21. May 29, 1967. (81 Stat. 30)

Air pollution p. 37.

16. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1968. Public Law 90-132. November 8, 1967. (81 Stat. 386)

Air pollution p. 397.

17. Air Quality Act of 1967. Public Law 90-148. November 21, 1967. (81 Stat. 485)

An Act to amend the Clean Air Act to authorize planning grants to air pollution control agencies; expand research provisions

relating to fuels and vehicles; provide for interstate air pollution control agencies or commissions; authorize the establishment of air quality standards, and for other purposes. Enforcement provisions for federal-state standard setting for air quality control regions. Streamlined enforcement process. Registration of fuel additives. Establishment of advisory groups.

18. Departments of Labor and Health, Education, and Welfare Appropriation Act, 1969. Public Law 90-557. October 11, 1968. (82 Stat. 969)

Air pollution p. 981.

19. Clean Air Act Amendment. Public Law 91-137. December 5, 1969. (81 Stat. 283)

To extend for one year the authorization for research relating to fuels and vehicles under the provisions of the Clean Air Act.

20. National Environmental Policy Act of 1969. Public Law 91-190. January 1, 1970. (83 Stat. 852)

To establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes.

21. U. S. President. Executive Order 11507. "Prevention, Control and Abatement of Air and Water Pollution at Federal Facilities." Federal Register, vol. 35, no. 25, February 5, 1970, pp. 2573-2576.

The prevention, control and abatement of air pollution as defined by the purpose of the Clean Air Act as amended and the National Environmental Policy Act of 1969 is extended to include all projects or installations owned or leased to the federal government so as to conform with air and water quality standards-- present and future-- which are established under federal legislation.

22. Departments of Labor and Health, Education, and Welfare and Related Agencies Appropriations Act, 1970. Public Law 91-204. March 5, 1970. (84 Stat. 23)

Air pollution control p. 27.

23. Environmental Quality Improvement Act of 1970. Public Law 91-224. April 3, 1970. (84 Stat. 114)

The Environmental Quality Improvement Act was enacted as Title II of P.L. 91-224, Title I of which amended the Federal Water Pollution Control Act. It authorizes an Office of Environmental Quality which shall provide the professional and administrative staff for the Council for Environmental Quality. The authorizations provided by this Act extend to June 30, 1973, and are in excess of those authorized by P.L. 91-190.

24. U. S. President. Proclamation. "Reorganization Plan No. 3 of 1970." Federal Register, vol. 35, no. 194, October 6, 1970, pp. 1563-1566.

Transmitted to the Congress on July 9, 1970, the proposal of the President to establish the Environmental Protection Agency became effective October 2, 1970, under the provisions of Ch. 9 of Title 5 USC.

25. Clean Air Amendments of 1970. Public Law 91-604. December 31, 1970. (84 Stat. 1676)

An Act to amend the Clean Air Act to provide for a more effective program to improve the quality of the nation's air. It sets deadlines for the reduction of certain hazardous automobile emissions and it includes authorizations of \$1.1 billion over three fiscal years.

1.2 Congressional Hearings and Government Reports

26. U. S. Congress. House. Government Operations Committee. The Environmental Decade. (Action Proposals for the 1970's). Hearings before a Subcommittee on Conservation and Natural Resources, February-April 1970. (91st Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1970. 361p.

Hearings held to explore existing and imminent environmental problems; to discover what must be done to solve them; to examine the effectiveness and efficiency of existing government policies and programs; and to develop proposals for new programs where needed.

27. U. S. Congress. House. Government Operations Committee. Reorganization Plan No. 3 of 1970 (Environmental Protection Agency). Hearings before Subcommittee on Executive and Legislative Reorganization, July-August 1970. (91st Cong. 2d sess.) Washington, U. S. Print. Off., 1970. 209p.

The Environmental Protection Agency proposed by the President would bring together pollution control programs existing in four separate agencies and an interagency council.

28. U. S. Congress. House. Interstate and Foreign Commerce Committee. Air Pollution Control and Solid Wastes Recycling. Hearings before the Subcommittee on Public Health and Welfare on HR 12934, HR 14960, HR 15137, and HR 15192, December, March, April 1970. (91st Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1970. 2pts.

Bills to amend the Clean Air Act were discussed: to extend its duration, provide for national standards of ambient air quality, expedite enforcement of air pollution control standards, authorize regulation of fuels and fuel additives, provide for improved controls over motor vehicle emissions, establish standards applicable to dangerous emissions from stationary sources, and for other purposes.

29. U. S. Congress. House. Interstate and Foreign Commerce Committee. Air Quality Act of 1967. Hearings on H.R. 9509 and related bills, S. 780, August 15-24, 1967. (90th Cong., 1st sess.) Washington, U. S. Govt. Print. Off., 1967. 887p.

Amendments to the Clean Air Act: to improve and expand the authority to conduct research relating to air pollutants, to assist in the establishment of regional air quality commissions, to authorize establishment of standards and other provisions as recommended by the administration, are discussed.

30. U. S. Congress. House. Interstate and Foreign Commerce Committee. Air Quality Act of 1967. Report of the Committee together with additional views to accompany S. 780. (90th Cong., 1st sess., Report no. 90-728) Washington, U. S. Govt. Print. Off., October 1967. 97p.

The report follows in general the pattern of the bill as passed by the Senate with some modifications. It is intended primarily for air pollution control on a regional basis in accordance with air quality standards and enforcement plans developed by the states.

31. U. S. Congress. House. Interstate and Foreign Commerce Committee. Clean Air Act Amendments of 1970. Report to accompany H. R. 17255. (91st Cong., 2d sess., Report no. 91-1146) Washington, U. S. Govt. Print. Off., June 1970. 53p.

The report states that progress in controlling air pollution since the enactment of the 1967 legislation has been "regrettably slow." The new bill authorizes the Secretary of HEW to establish nationwide air quality standards, to set emission standards for aircraft and aircraft engines, and for the composition of fuel or fuel components.

32. U. S. Congress. House. Science and Astronautics Committee. Adequacy of Technology for Pollution Abatement. Hearings before the Subcommittee on Science, Research and Development, July-September 1966. (89th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1966. 2v.

Evidence that existing technology to achieve the objectives of existing legislation for the control of environmental pollution and the need for new technology are discussed.

33. U. S. Congress. House Science and Astronautics Committee. The Adequacy of Technology for Pollution Abatement. Report of the Research Management Advisory Panel through Subcommittee on Science, Research and Development. (89th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1966. 17p.

The report recommends certain areas of further inquiry based on the technical capabilities which underlie the national effort to control environmental pollution.

34. U. S. Congress. House. Science and Astronautics Committee. Environmental Quality. H.R. 7796, H.R. 13211, H.R. 14605, H.R. 14627. Hearings before the Subcommittee on Science, Research and Development, January-March 1968. (90th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1968. 588p.

These hearings are a sequence to those held in 1966 scheduled to explore the way in which science resources available to the federal government are developed in support of national goals for environmental quality and to stress the crucial role for science and technology in pollution abatement.

35. U. S. Congress. House. Science and Astronautics Committee. Managing the Environment. Report of the Subcommittee on Science, Research and Development. (89th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1968. 59p.

A summary of current information from the hearings of the same committee held earlier in the year, subcommittee consultants, and staff studies. Recommendations of the report emphasize that, in this rapidly changing situation, it will be necessary to make continuing reviews seeking those additional recommendations which will be needed in the future.

36. U. S. Congress. Senate. Commerce Committee. Automobile Steam Engine and Other External Combustion Engines. Joint hearings before Committee on Commerce and Subcommittee on Air and Water Pollution of Committee on Public Works, Senate, May 1968. (90th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1968. 272p.

The Department of Commerce, Panel on Electrically Powered Vehicles' report, The Automobile and Air Pollution, suggested that steam car technology has progressed to the point where it could be the most "reasonable alternative to the internal combustion engine in terms of meeting both performance and emission requirements." These hearings were scheduled to discuss specific advantages which steam engine might offer.

37. U. S. Congress. Senate. Commerce Committee. Electric Vehicles and Other Alternatives to Internal Combustion Engine. Joint hearings before Committee on Commerce and Subcommittee on Air and Water Pollution, Committee on Public Works, Senate, on S. 451 and S. 453, March-April 1967. (90th Cong., 1st sess.) Washington, U. S. Govt. Print. Off., 1967. 550p.

Hearings to amend the Clean Air Act: to authorize an investigation and study to determine means of propelling vehicles so as not to contribute to air pollution and to authorize a program of development and demonstration for electrically powered vehicles.

38. U. S. Congress. Senate. District of Columbia Committee. Problems of Air Pollution in the District of Columbia. Joint hearings before the Subcommittee on Business and Commerce and Subcommittee on Public Health, Education, Welfare and Safety, March 8-16, 1967. (90th Cong., 1st sess.) Washington, D. C., U. S. Govt. Print. Off., 1967. 838p.

The hearings represent the most exhaustive treatise on the status of air pollution in the nation's capital. All the possible aspects of the problem are discussed and commented on in the light of previously conducted major pertinent studies such as those made of the county of Los Angeles and the Chicago Metropolitan Area, respectively.

39. U. S. Congress. Senate. Government Operations Committee. Reorganization Plan No. 3 of 1970, Providing for the Establishment of the Environmental Protection Agency. (91st Cong., 2d sess., Report no. 91-1250) September 1970. 8p.

The committee concluded that there is an urgent need for the immediate establishment of an independent agency which would be responsible for the establishment and enforcement of environmental protection standards.

40. U. S. Congress. Senate. Government Operations Committee. Reorganization Plans Nos. 3 and 4 of 1970. Hearings before the Subcommittee on Executive Reorganization and Government Research, July-September 1970. (91st Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1970. 217p.

The President's reorganization plan to establish the Environmental Protection Agency and the National Oceanic and Atmospheric Administration within the Department of Commerce is discussed.

41. U. S. Congress. Senate. Interior and Insular Affairs Committee. Joint House-Senate Colloquium to Discuss National Policy for Environment. Hearing before Committee on Interior and Insular Affairs, Senate, and Committee on Science and Astronautics, House, July 1970. (90th Cong., 2d sess.) Washington, 1968. 233p.

An informal study session designed to obviate certain jurisdictional limitations of the committees represented. A collaboration in a survey of policies for environmental management is sought in order that all the committees concerned might gain fuller knowledge and understanding of the requirements for effective legislation and an overview in this field.

42. U. S. Congress. Senate. Interior and Insular Affairs Committee. National Environmental Policy Act of 1969. Report to accompany S. 1075 (91st Cong., 1st sess., Report no. 91-296) Washington, U. S. Govt. Print. Off., 1969. 48p.

The purposes of the Act on which the committee reported were: to declare a national policy on the environment; to enrich the

understanding of the ecological systems by authorizing the Secretary of the Interior to conduct investigations, research, etc., and to establish a Council on Environmental Quality.

43. U. S. Congress. Senate. Public Works Committee. Air Pollution Control. Hearings before the Special Subcommittee on Air and Water Pollution. Washington, U. S. Govt. Print. Off., 1965. 308p.

The proposed bill was introduced to amend the Clean Air Act to require standards for controlling the emission of pollutants from gasoline-powered or diesel-powered vehicles, to establish a federal air pollution control laboratory and for other purposes.

44. U. S. Congress. Senate. Public Works Committee. Air Pollution, 1967 (Air Quality Act). Hearings before Subcommittee on Air and Water Pollution on S. 780 and related matters pertaining to prevention and control of air pollution, February-May 1967. (90th Cong., 1st sess.) Washington, U. S. Govt. Print. Off., 1967. 4 parts.

The hearings were conducted in Washington, D. C., and several other cities to consider the present status of the air pollution control and abatement programs. The principal legislative proposal S. 780 is the President's recommendation for an accelerated attack on the contamination of the air.

45. U. S. Congress. Senate. Public Works Committee. Air Pollution 1968. Hearings before the Subcommittee on Air and Water Pollution, on air pollution compacts: S. 2350, S.J. Res. 95, S. 470. (90th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1968. 522p. pt.1.

Hearings held on air pollution compacts: for West Virginia-Ohio, Mid-Atlantic states and Illinois-Indiana regional, air pollution control and other matters pertaining to systematic methods for the development of air quality control regions which relate to meteorological conditions, to population, political boundaries and to urban industrial concentrations.

46. U. S. Congress. Senate. Public Works Committee. Air Pollution - 1969. Hearing before the Subcommittee on Air and Water Pollution, St. Louis, Missouri, October 1969. (91st Cong., 1st sess.) Washington, U. S. Govt. Print. Off., 1970. 244p.

The adequacy of regional air quality control systems are discussed in relation to the St. Louis metropolitan area. In view of the recent air pollution episode and the development of the complex interstate and multijurisdictional arrangements, standards of air quality to be developed and enforced are discussed.

47. U. S. Congress. Senate. Public Works Committee. Air Pollution - 1970. Hearings before the Subcommittee on Air and Water Pollution on S. 3229, S. 3466, and S. 3546, March 1970. (91st Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1970. 4 pts.

The National Air Quality Standards Act of 1970, and the Clean Air Act Amendments of 1970 are discussed focusing on ways to control sources of pollution and to discourage the introduction into the environment of sources which cannot be controlled, or the acceptance of a policy that controls only those sources that are easily or conveniently controlled.

48. U. S. Congress. Senate. Public Works Committee. Air Quality Act of 1967, Amending Clean Air Act as Amended. Report to accompany S. 780. (90th Cong., 1st sess., Report no. 90-403) Washington, U. S. Govt. Print. Off., July 1967. 86p.

The administration's proposal was amended to "provide a comprehensive, broad-based attack on the pollution problem while expanding the potential of control technology and identifying the health and welfare effects of air pollution." The report calls for the establishment of ambient air quality standards, enforceable ambient air quality standards, development of regional implementation of standards and provision of required stimuli to industry and government to improve emission control technology.

49. U. S. Congress. Senate. Public Works Committee. Air Quality Criteria. Staff report prepared for use of Subcommittee on Air and Water Pollution, July 1968. (90th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1968. 69p.

This report summarizes the existing evidence on the nature, type and extent of air pollution health effects.

50. U. S. Congress. Senate. Public Works Committee. National Air Quality Standards Act of 1970. Report to accompany S. 4358. (91st Cong., 2d sess., Report no. 91-1196) Washington, U. S. Govt. Print. Off., 1970. 129p.

The Senate reported a three-year, \$1.22 billion extension of the Clean Air Act, including a provision that automobiles must be made 90-percent pollution free by 1975.

51. U. S. Congress. Senate. Public Works Committee. Recommendations of Committee on Public Works to Committee on Judiciary Regarding Conditional Consent of Congress to Various Interstate Air Pollution Control Compacts: S. 470, S.J. Res. 95, and S. 2350. (90th Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1968. 9p.

The committee recognizes the importance of cooperative action by the states for the purpose of preventing and controlling air pollution. Some additional provisions as to broaden authority on the part of commissions and effective enforcement and resolving deadlock situations arising between the party states are indicated.

52. U. S. Congress. Senate. Public Works Committee. Report of the Council on Environmental Quality. Hearings before the Subcommittee on Air and Water Pollution, August 1970. (91st Cong., 2d sess.) Washington, U. S. Govt. Print. Off., 1970. 28p.

The main recommendations of the council's report for a national energy policy, a national transportation policy and a national land-use policy are discussed.

53. U. S. Council on Environmental Quality. Environmental Quality (First Annual Report) Washington, U. S. Govt. Print. Off., 1970.

The report seeks to describe the conditions of our environment and to identify major trends, problems, actions underway and opportunities for the future. The opening chapter deals with the growing awareness and understanding by the American people of the nature of the threat to the environment and the inter-relationship of environmental problems. Subsequent chapters discuss various forms of pollution and local antipollution programs; control of land use; the expansion of population; waste of resources; international cooperation; the need for better, stronger institutions, improved measurement of the environment and comprehensive policies and strategies.

54. U. S. Department of Health, Education, and Welfare. Air Pollution by Federal Facilities: Report of the Secretary of Health, Education, and Welfare to the Congress of the United States. (90th Cong., 2d sess., S. Doc. no. 72.) Washington, U. S. Govt. Print. Off. 11p.

55. _____. Air Pollution Abatement by Federal Facilities: Second Report . . . (91st Cong., 1st sess., S. Doc. no. 91-10) Washington, U. S. Govt. Print. Off. 28p.

56. _____. Air Pollution Abatement by Federal Facilities: Report (91st Cong. 2d sess., S. Doc. 91-77) Washington, U. S. Govt. Print. Off., 1970. 35p.

The Secretary of HEW is required under the provisions of the Air Quality Act of 1967 to transmit annually a report on measures being taken by federal agencies to control the emission of air pollutants from sources for which federal departments or agencies have jurisdiction.

57. U. S. Department of Health, Education, and Welfare. Cost of Clean Air: First Report of the Secretary of Health, Education, and Welfare to Congress. (91st Cong., 1st sess., S. Doc. no. 40). Washington, U. S. Govt. Print. Off., October 1969. 53p.

This report gives estimated costs of air pollution control efforts under the Air Quality Act of 1967 during FY 1969-74.

It is estimated that governmental expenditures will grow at an annual rate of about 30 percent. Estimates of industrial spending were developed for fuel combustion sources and selected industrial process sources located in 85 metropolitan areas.

58. _____. Cost of Clean Air: Second Report of the Secretary of Health, Education, and Welfare to Congress. (91st Cong., 1st sess., S. Doc. no. 65). Washington, U. S. Govt. Print. Off., 1970. 104p.

As the first report, this one gives estimated costs to meet selected standards as well as implementing governmental air pollution control programs; however, it covers a larger number of pollutants, stationary sources and metropolitan areas, and it bases the cost estimates on different emission control regulations.

59. U. S. Department of Health, Education, and Welfare. National Emission Standards Study. Report of the Secretary of HEW to Congress. Washington, D. C., March 1970. 146p. Appendixes.

"The Clean Air Act, as amended, calls for a study of the need for, and effect of, national emission standards for stationary sources of air pollution. In response to the directive contained in the Clean Air Act (Section 211a), this report was prepared by the National Air Pollution Control Administration. The report effectively covers the five major specifications of Section 211a: information regarding identifiable health and welfare effects from single emission sources; examples of specific plants which constitute a danger to public health or welfare; a list of industries which should be subject to emission standards; the relationship of emission standards to air quality; an analysis of the cost of applying emission standards. There is a need to insure adoption and enforcement of emission restrictions applicable to all significant stationary sources of air pollution. Three alternative ways of meeting this need have been identified and evaluated. It is recommended that the Clean Air Act be amended in such a way as to provide for adoption of national air quality standards, State adoption of implementation plans for all areas, adoption of national emission standards for major new stationary sources of air pollution and all stationary sources of extremely hazardous pollutants, broadening of Federal enforcement authority, and streamlining of Federal enforcement procedures."

60. U. S. Department of Health, Education, and Welfare. Progress in the Prevention and Control of Air Pollution; Report of the Secretary of Health, Education, and Welfare to Congress. (90th Cong., 2d sess., S. Doc. no. 90-92) Washington, U. S. Govt. Print. Off., 1968. 85p.

61. _____. Second Report . . . (91st Cong., 1st sess., S. Doc. no. 91-11) Washington, U. S. Govt. Print. Off., 1969. 60p.

62. _____ . Third Report. . . (91st Cong., 2d sess., S. Doc. no. 91-64)
Washington, U. S. Govt. Print. Off., 1970. 39p.

The Secretary of HEW is required by the Clean Air Act, as amended, to report to Congress on the progress being made in the United States to prevent and control air pollution. The report includes sections on the development of air quality criteria and recommended emission control requirements, the status of state ambient air standards setting, the status of state, interstate and local pollution control programs established and assisted by the Air Quality Act of 1967 and other reports and recommendations.

63. U. S. Panel on Electrically Powered Vehicles. The Automobile and Air Pollution: A Program for Progress. Washington, U. S. Govt. Print. Off., October 1967. 51p.

First report of a Department of Commerce advisory committee. The panel has attempted to provide analysis and recommendations which can serve as a basis for immediate action. The uncertainty and risk which pervade the establishment of public policy in the area of air pollution control require that a number of simultaneous steps be taken. The role of government is presented in eight recommendations out of a total number of sixteen given.

64. U. S. President's Science Advisory Committee. Environmental Pollution Panel. Restoring the Quality of Our Environment. Washington, U. S. Govt. Print. Off., 1965. 317p.

A general survey of various forms of pollution with a brief review of air problems. Recommendations are given for future policy on federal and local levels, future action, coordination and system studies, development of existing technology, research, manpower training is identified.

65. U. S. Public Health Service. Air Pollution Control Program Support Under Air Quality Act of 1967, Public Law 90-148, December 1968.
Washington, D. C., December 1968. 4p.

"The objective of the National Air Pollution Control Administration, through its Control Agency Development Division, is to assist in the development, strengthening and support of state, regional and local air pollution control programs by (1) providing grant-in-aid assistance; and (2) providing technical assistance to official agencies conducting such control programs."

2. VOLUNTARY COMPLIANCE

66. Cuffe, Stanley. "Cooperative Industry Trade Association -- Public Health Service Atmospheric Emission Studies." Paper presented at the National Council for Stream Improvement Meeting, New York, N. Y., February 20, 1968. 11p.

A brief description is given of the various program activities in the National Center for Air Pollution Control. A discussion is presented of several atmospheric emission studies conducted by the Public Health Service and a cooperative industry trade association. Also presented is a description and status report of a cooperative study of pulp and paper industry atmospheric emissions and their control.

67. Davies, J. Clarence, III. "Compliance" in: The Politics of Pollution, New York, Pegasus, 1970, pp. 176-192, 201-203.

Compliance is the most vulnerable part of the pollution control process and the stage at which failure is most likely. The problem of achieving compliance has led to a consideration of methods other than the usual standards and enforcement approach.

68. DeGroot, I. "Trends in Public Attitudes Toward Air Pollution." J. Air Pollution Control Association, vol. 17, no. 10, October 1967, pp. 679-681.

An attempt is made to bring together the findings relative to people's attitudes about air pollution from a series of studies conducted by or for the U. S. Public Health Service.

69. Farrell, Richard J. "Let the Polluter Beware." Case and Comment, vol. 75, no. 5, September-October 1970, pp. 3-8.

Directing his comments to representatives of industry, the author outlines the trends in pollution legislation and judicial decisions and suggests that industry must attune its outlook to these new interpretations of the law and learn how to live with them.

70. Hill, Gladwin. "The Politics of Air Pollution: Public Interest and Pressure Groups." Arizona Law Review, vol. 10, 1968, pp. 37-47.

This article provides a general discussion of the ambivalent attitudes of both government and industry and comments on the influence of citizen pressure groups. Although air pollution is a nonpartisan problem, it must be handled by government and therefore must involve the reconciliation of these many different interests.

71. Ludwig, John H. "Government-Industry Cooperation in Air Pollution Control Research and Development: Is the Time Ripe?" Harvard Public Health Alumni Bulletin, vol. 25, no. 2, July 1968, pp. 13-17.

Following a general discussion of Congressional legislative response to air pollution problems, the author proposes the creation of a government-industry partnership in order to optimize available financial and technical resources. Voluntary compliance, he believes, is an appropriate approach to air pollution control. Preliminary studies on pollutants, heavy industry and equipment are also recommended.

72. Moody, Joseph E. "The Opportunity for Industry-Government Partnership Offered by the Air Quality Act of 1967." Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn., June 23-27, 1968. 11p.

The types of cooperation which must exist between government and industry in order to achieve the goals of the Air Quality Act of 1968 are discussed. The government must not impose impossible restrictions or timetables on industry, and industry must not cry wolf at every bit of control legislation.

73. Neilson, C. A. "Regional Air Quality Standards" in: American Petroleum Institute, Proceedings, vol. 49, 1969, pp. 592-614.

It is important that regional air quality standards be very carefully and scientifically established to obtain the optimum and essential results without excessive cost and economic disruption. Active participation by industry in the setting of standards and in the development of enforcement plans is essential, especially in making known the economics and limitations of present control technology. The American Petroleum Institute Committee for Air and Water Conservation is active in sponsoring research in many fields relating to air quality. It has sponsored symposia on this subject and has commissioned many eminent consultants to prepare critical surveys.

74. Olds, F. C. "Air Pollution Control: Good Intentions in Search of Direction." Power Engineering, vol. 73, no. 9, September 1969, pp. 28-35.

Industries are inclined to abide by legal directives to abate pollution, but major roadblocks in politics and government prevent progress. It was concluded that the single most important matter is for the authorities to declare a fixed set of principles by which management may be guided.

75. Ridgeway, James. The Politics of Ecology. New York, Dutton, 1970, 222 p.

A journalistic account of corporate polluters and their pollution-causing activities. The author's proposals for change contain few reforms for controlling pollution, but are designed instead to attack concentrated corporate power, the source of pollution, thereby opening up possibilities for change.

76. Swan, James. "Response to Air Pollution; A Study of Attitudes and Coping Strategies of High School Youths." Environment and Behavior, vol. 2, no. 2, September 1970, pp. 127-152.

An exploratory study conducted among male high school seniors in Detroit. The techniques employed to evaluate responses are described. Race and socio-economic status are among the factors referred to in a discussion of relationships between a passive awareness, a positive knowledge, and an active concern for air pollution. A review of the literature on "man's response to environmental problems" is also contained.

77. Transcript of Proceedings: Department of Health, Education, and Welfare, Government-Industry Meeting on Voluntary Installation of Improved Low-Smoke Combusters on Jet Aircraft; Washington, D.C., August 28, 1969. Washington, D.C. (Ace Federal Reporter Inc.), 1969. 90 p. app.

78. Transcript of Proceedings: NAPCA/FAA/Airline Industry Meeting; Washington, D.C., Jan. 20, 1970. Washington, D.C. (Ace Federal Reporters Inc.), 1970. 60 p.

Exploratory meeting between the National Air Pollution Control Administration and the airline companies to discuss retrofit of some 3,000 gas turbine engines failed to produce any constructive agreement on the basis of voluntary compliance. After the second, more successful meeting, a joint press release was issued indicating industry cooperation.

3. EMISSION STANDARDS

3.1 Comments on Federal Role

79. "The Air Quality Act of 1967." J. Air Pollution Control Association, vol. 18, no. 2, February 1968, pp. 62-71.

The Air Quality Act of 1967 is a blueprint for a systematic effort to deal with air pollution problems on a regional basis. It calls for coordinated action at all levels of government and among all segments of industry. The major provisions of the 1967 act are reviewed.

80. Anthony, M. V. "The Air Quality Act-- Some Progress and Problems." Chemical Engineering Progress, vol. 66, no. 3, March 1970, pp. 23-25.

The effect of the Air Quality Act of 1967 on the chemical industry is examined. Beyond assuring health protection, consideration should be given next to the applicable scientific and technical information available to accomplish control. Subsequently, cost-benefit relationships should be considered.

81. Broughton, Robert. "Air Pollution and the Law." Appalachia, vol. 3, no. 9, June-July 1970, pp. 11-19.

"The fight for clean air requires action at the federal, state and local levels, and broad citizen interest." As population, industries and urban areas expand, continual review of social processes and procedures are needed to assure that air pollution is controlled and reduced. Present federal, regional, state and local action is reviewed.

82. "Civilization is the Major Cause of Air Pollution." Congressional Quarterly Weekly Report, vol. 28, no. 23, June 5, 1970, pp. 1505-1509.

A review of sources of air pollution is presented and legislative proposals at the federal government level are reviewed. The future outlook for air pollution control is discussed in terms of short-range and long-range solutions.

83. "Congress Focuses on Environmental Quality." Environmental Science and Technology, vol. 4, no. 2, February 1970, pp. 103-105.

The National Environmental Policy Act of 1969 is called the most important and far-reaching conservation-environmental measure ever cleared by any Congress. P.L. 91-190 states a national environmental policy and declares national goals; authorizes and directs all federal agencies to administer their existing laws, regulations and policies in conformance with this act; requires submission of an annual environmental quality report; establishes a three-member Council of Environmental Quality in the Executive Office of the President.

84. Cooley, Richard A. and Geoffrey Wandesforde-Smith (eds.) Congress and the Environment. Seattle, University of Washington Press, 1970. 277 p.

A case study approach is presented to evaluate congressional action on conservation and pollution. Each chapter surveys a recent piece of legislation to determine how Congress has handled a particular environmental problem.

85. Davies, J. Clarence, 3d. The Politics of Pollution. New York, Pegasus, 1970. 232 p.

Chapters 2 and 3 of this book deal with federal pollution control legislation, the forces which shape pollution policy at the federal level and the congressional legislative and appropriation processes.

86. Degler, Stanley E. and S. C. Bloom. Federal Pollution Control Programs: Water, Air and Solid Wastes. Washington, D.C., Bureau of National Affairs, 1969. 111 p.

This work inventories available federal pollution control programs and discusses the legislation and standards for the prevention of damage to the environment. Federal programs in the areas of air and water pollution control and the disposal of solid waste are explained. In addition, the status of all enforcement action is summarized.

87. Edelman, S. "The Law of Federal Air Pollution Control." J. of Air Pollution Control Association, vol. 16, 1966, pp. 523-525.

The statutory procedures and the scope of federal authority under the 1963 Clean Air Act, as amended, are analyzed and discussed.

88. "Environmental Protection Agency and National Oceanic and Atmospheric Administration." Weekly Compilation of Presidential Documents, vol. 6, no. 28, July 13, 1970, pp. 908-916.

The EPA, as proposed, would bring together in a single organization the major federal pollution control programs now existing in four separate agencies and one interagency council.

89. "Far Reaching Bill Pending in Congress Would Launch Major New Attacks on Air Pollution." CF Letter (Conservation Foundation), October 1970, pp. 1-12.

Congress is now considering legislation which seeks to lay the groundwork for a major breakthrough in the campaign against air pollution. The legislation embodies some drastic new concepts, some severe new restrictions and some heavy new responsibilities and costs, it challenges basic economic and social canons, it envisions the imposition of blunt restraints on environmentally irresponsible economic growth, land use and automobile driving and it advances the theory that the ordinary citizen has the right to go to court and force industry and government to protect his environment.

90. Farrell, Richard J. "Let the Polluter Beware." Case and Comment, vol. 75, no. 5, September-October 1970. pp. 3-8.

The author outlines recent trends in legislation and judicial decisions with respect to pollution control. Directing his comments to representatives of industry, he suggests that industry must attune its outlook to these new interpretations of the law and learn how to live with them.

91. Federal Council for Science and Technology. Committee on Environmental Quality. Fiscal Year 1968 and 1968 Federal Expenditures on Research, Development, and Demonstration Related to Pollution. Washington, D.C., Executive Office of the President, Office of Science and Technology, May 6, 1968. (19 p.)

The results of an analysis of federal support for research, development, and demonstration programs for environmental pollution are presented. Detailed data on individual agencies' expenditures on the effects of air pollution, dispersion of pollutants, measurement and instrumentation methods, sources of pollution, and studies on the social, legal, economic, and control aspects of pollution are tabulated.

92. Fromson, Jeffrey. "A History of Federal Air Pollution Control." Ohio State Law Journal, vol. 30, no. 3, Summer 1969. pp. 516-536.

This article deals with the legislative history of the Air Quality Act of 1967. Federal legislation with respect to air pollution control has gone through various stages in its evolution. However, air pollution is evolving at an even greater pace. As a result, increased federal action has not been successful in eliminating the problem of increased pollution of the atmosphere. The author maintains that an ultimate solution will require a change in the present value system. Despite the evident danger of air pollution, many citizens still resist the reasoning that cut-backs in technological development and industrial growth are required.

93. Gaulding, Clark L. "Definition of Air Quality Control Regions; Approach and Experience to Date." J. Air Pollution Control Association, vol. 18, no. 9, September 1968, pp. 591-595.

This article gives a status report on the steps taken by NAPCA to implement Section 107.(a)(2) of the Clean Air Act as amended by the Air Quality Act of 1967. The Section stipulates that Air Quality Control Regions be designated on the basis of jurisdictional boundaries, urban-industrial concentrations, and other factors necessary to provide adequate implementation of air quality standards.

94. _____. "Regional Approach to Air Pollution Abatement Gains Momentum." Environmental Science and Technology, vol. 3, no. 5, May 1969, pp. 431-434.

Progress in dealing with air pollution is evidenced by the acceptance of the concept of Air Quality Control Regions. The procedure being followed by NAPCA for designating Air Quality Control Regions is based on diffusion modeling. Analysis of the basic data on air quality, meteorology, and emissions, together with the computerized modeling results, gives some indication as to the physical dimension of the problem and the required size of the region.

95. Henderson, J. S. "Planning for Air Pollution Control. Part 1 - Laws and Their Impact." Plant Engineering, vol. 24, no. 12, June 1970, pp. 94-97.

The Clean Air Act of 1967 designates 91 Air Quality Control Regions and makes each state responsible for adopting regional air quality standards and for developing an abatement procedure plan. The central cities of the Air Quality Control Regions are specified in this article, and the need of control agencies to include emission standards in their implementation plan is discussed.

96. High, M. Dean and W. H. Megonnell. "Pollution Control: Federal Leadership." Mechanical Engineering, vol. 91, no. 2, February 1969, pp. 20-23.

Executive Order No. 11282, issued in 1966, requires that all federal agencies take steps to prevent and control air pollution from their installations. Sulfur oxide emission rates have been established for all federal facilities in three densely populated cities: New York, Philadelphia, and Chicago.

97. Ludwig, John H. "Government-Industry Cooperation in Air Pollution Control Research and Development: Is the Time Ripe?" Harvard Public Health Alumni Bulletin, vol. 25, no. 2, July 1968, pp. 13-17.

A general discussion of congressional legislative response to air pollution problems, followed by the author's proposals for the creation of a government-industry partnership in order to optimize available financial and technical resources. Preliminary studies on pollutants, heavy industry and equipment are also recommended.

98. Marshall, J. R. "Current Legislation." Chemical Engineering, vol. 77, no. 9, April 27, 1970, pp. 17-20.

"President Nixon's legislative package proposes key changes in existing federal laws, particularly those governing air quality. His opponents in Congress have many plans of their own as the public outcry over the state of our environment reaches a high pitch."

99. Martin, Robert and Lloyd Symington. "A Guide to the Air Quality Act of 1967." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 239-274.

The new law builds on earlier legislation going back as far as 1955 and is in form an amendment of the Clean Air Act of 1963. The Air Quality Act, however, goes somewhat farther in shaping the coordinated federal-state-local regulatory effort that air pollution control requires.

100. Megonnel, W. H. and S. S. Griswold. "Federal Air Pollution Prevention and Abatement Responsibilities and Operations." J. Air Pollution Control Association, v. 16, 1966, pp. 252-259.

The 89th Congress expanded and intensified the direct federal role in air pollution control to include abatement of international pollution, among other things. The experiences under interstate abatement authorities of the Clean Air Act and plans for future activities under the new authorities are discussed.

101. Middleton, John T. "Air Pollution Control: Preventive Medicine." Archives of Environmental Health, vol. 18, no. 5, May 1969, pp. 834-838.

Studies of evidence only point the way to understanding some of the effects of air pollution on health. However, the best preventive medicine in dealing with air pollution is control at its major sources. The Air Quality Act of 1967 has provided tools for achievement of effective control of air pollution on a regional basis. Some of the activities resulting from implementation of this act are reviewed.

102. _____. "Legislating Clean Air." Chemical Engineering, vol. 75, no. 20, October 14, 1968.

The Air Quality Act of 1967 is summarized and the opportunities offered both the private and public sectors of society to contribute to the solution of the air pollution problem are reviewed.

103. Myers, Frank. "Nonsense and Niggardliness are Undermining Pollution Control." Modern Manufacturing, vol. 1, no. 4, September 1968, pp. 184-190.

Although the federal government has enacted legislation for air and water pollution abatement, it ignores wastes discharged from its own facilities. Examples are given.

104. "NAPCA 'Emissions' Report Recommends National Air Quality Standards." J. Air Pollution Control Association, vol. 20, no. 7, July 1970, pp. 472-473.

The recommendations of the National Air Pollution Control Administration concerning national air quality standards are summarized. Large stationary sources of pollution are significant contributors to the deterioration of community air quality, and are sometimes the major contributors to pollution in specific areas. Three major methods of adopting and enforcing emission limitations for major stationary sources are outlined.

105. O'Fallon, John E. "Deficiencies in the Air Quality Act of 1967." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 275-296.

The author contends that the 1967 Act does not give proper priority to the establishment and enforcement of national industrial emission standards, nor does it properly recognize and support the activities of local air pollution control agencies which have been, to date, the best equipped and most effective in abating air pollution.

106. Oppenheimer, Jack C. and Leonard A. Miller. "Environmental Problems and Legislative Responses" in: The Academy of Political and Social Science, Society and Its Physical Environment (Annals, vol. 389, May 1970), pp. 77-86.

Numerous congressional committees and executive agencies have become involved in proposing and administering multiple environmental policies which, at times, overlap or are in conflict. This situation has encouraged action to coordinate executive and legislative policies, plans and programs.

107. "Pollution: Everyone Wants a Piece of the Action." Congressional Quarterly Weekly Report, vol. 28, no. 17, April 24, 1970, pp. 1135-1138.

The environment has become an important political issue. The activities on Capitol Hill, and in government agencies are discussed in this article. "The present frenzy may not last, but evidence suggests the public will continue to worry about the environment-- and the Congress and the Federal Government will continue to act accordingly."

108. Ripley, Randall B. "Congress and Clean Air: The Issues of Enforcement, 1963" in: Frederick N. Cleaveland and others, Congress and Urban Problems, Washington, D.C., Brookings, 1969, pp. 224-278.

The article summarizes the evolution of environmental legislation as of 1963. Particular attention is paid to the Clean Air Act whose primary focus was those seriously polluted urban areas that had not yet started to solve the problem themselves.

109. "Senate Passes Stringent Antipollution Bill, 73-0." Congressional Quarterly Weekly Report, vol. 28, no. 39, September 25, 1970, pp. 2315-2320.

Senate passed a three year \$1.27-billion extension of the Clean Air Act, including a provision that automobiles must be made 90-percent pollution free by 1975. The Department of Health, Education, and Welfare is authorized to undertake major research efforts concerning fuels and vehicles and the effects of air and noise pollution, among other things. Bill then went to House-Senate conference. The article includes a comparison of the Administration, House and Senate Air Pollution Bills.

110. Stern, A. C. "Implications of the Air Quality Act of 1967." Transactions of the New York Academy of Sciences, vol. 30, April 1968, pp. 759-765.

The Air Quality Act of 1967 is assessed. It incorporates the body of federal air pollution legislation that had developed from 1955 through 1966, setting a firm basis for the outgoing programs of research, training, technical, and financial assistance, and interstate and motor vehicle pollution abatement.

111. Sundquist, James L. "For All a Better Outdoor Environment" in: Politics and Policy; the Eisenhower, Kennedy and Johnson Years. Washington, D.C., Brookings, 1968, pp. 322-381.

In attempt to answer the question why and how, in its policy-making processes, does the United States government alternate between spurts of active energy and relative inaction, the author considers air pollution policies as part of the environment policy.

112. Sussman, V. H. "The Utilization of Air Quality Criteria and Standards." J. of Air Pollution Control Association, vol. 19, no. 2, February 1969, pp. 73-76.

There is a widespread belief that air quality criteria in themselves are a strong enforcement tool in air pollution control. The techniques employed in developing specific criteria are discussed and the limitations of specific criteria are presented. Only with this understanding can criteria be converted to "standards" and employed in emission control regulations.

113. Vanishing Air. Report of the Task Force on Air Pollution, Center for Study of Responsive Law. John Esposito (ed.), New York, Grossman, 1970. 328 p.

This report of the Ralph Nader Study Group on Air Pollution, written by a group of graduate students in law, medicine, science, and engineering, probes "not only the failure of legislators and administrators to develop and deploy the law against polluters but also the tragic distortion of the law and legal processes into shields for polluters against citizen participation and the public's health."

114. "Will the President's Reorganization Plans Lead to Better Management of the Environment?" CF Letter (Conservation Foundation), September 1970, pp. 1-12.

The President has proposed a major realignment of federal agencies designed to achieve better management. One of the hardest environmental problems is that of organizing the federal bureaucracy to deal effectively with the many overlapping and conflicting demands on environmental resources. Reorganization Plan No. 3 proposed the creation of an independent Environmental Protection Agency (EPA) reporting directly to the President. EPA would combine 13 existing programs now in five departments or agencies.

3.2 Comments on State and Local Role

115. Aborn, Richard A. and Carl E. Axelrod. "States Air Pollution Control Legislation." Boston College Industrial and Commercial Law Review, vol. 9, Spring 1968, pp. 217-256.

Following a review of state air pollution control legislation, the authors conclude that although there is no doubt of the desirability of clean air, there is also no doubt that the major sources of air pollution are industries of great social and economic value. Consequently, there must be a balance struck between the reduction of air pollution and the allowance of industry to continue operation. The "prohibitory" and the "permit" systems of air pollution control are discussed.

116. "The Air Quality Act of 1967." Iowa Law Review, vol. 54, no. 1, 1968, pp. 115-140.

Following a review of the federal Air Quality Act of 1967 the author discusses the increased state activity generated at the state level to control air pollution. He points out that possible difficulties may arise regarding the practicability and feasibility of the state standards on which the success of the act depends.

117. "Approval Sought for Interstate Air Pollution Compacts." Environmental Science and Technology, vol. 2, no. 5, May 1968, pp. 330-331.

Criteria for determining whether a proposed compact would provide effective action for air pollution include: only states in the Air Quality Control Region should be in the compact; federal representation on an interstate compact commission is desirable, but federal voting membership is not; each participating state should have one vote; a compact should have authority to undertake activities leading to the prevention and control of air pollution; an adequate definition of air pollution should be included in the language of a compact; interstate compacts should enhance the ability of a number of states to carry out their function under the Clean Air Act.

118. Broughton, Robert. "Air Pollution and the Law." Appalachia, vol. 3, no. 9, June-July 1970, pp. 11-19.

"The fight for clean air requires action at the federal, state and local levels, and broad citizen interest." As population, industries and urban areas expand, continual review of social processes and procedures are needed to assure that air pollution is controlled and reduced. Present federal, regional, state and local action is reviewed with particular reference to the Appalachian area.

119. "California Sets Pace with New Air Pollution Laws." Environmental Science and Technology, vol. 4, no. 1, January 1970, pp. 10-12.

The 1969 California legislature passed and Gov. Reagan signed seven bills to reduce air pollution emissions in the state. A brief summary of the new legislation and a discussion of its likely consequences is included.

120. A Compilation of Selected Air Pollution Emission Control Regulations and Ordinances. Washington, D.C., Public Health Service, National Center for Air Pollution Control, 1968. 146 p. (PHS Publ. no. 999-AP-43.)

The regulations and ordinances (chosen as examples of the many types in use today) have been taken directly from the original text of individual state and local laws. The regulations and ordinances are arranged in such a manner that each section of the report is a compilation of laws pertaining to a specific type of pollution or pollutant source.

121. Croke, Edward J. and Samuel G. Booras. "Design of an Air Pollution Incident Control Plan." J. Air Pollution Control Association, vol. 20, no. 3, March 1970, pp. 129-138.

An urban air pollution incident presents a crisis situation which requires contingency plans prepared in advance and an effective control organization. A program of incident control tests has been initiated in Chicago. The author discusses the evolution of an incident control strategy from an initial, fixed response emission control exercise, through a meteorologically initiated control test to a fairly realistic war game series which is still developing.

122. Daley, A. C. "Problems in Statewide Uniform Air Quality Enforcement." Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn., June 23-27, 1968, 17 p.

The Rhode Island Clean Air Act went into effect on January 1, 1967. Since Rhode Island has only 1,082 square miles with approximately 900,000 people, uniform regulations would apply throughout the state. However, since Rhode Island has 39 municipalities with a surprising variance of population densities, resistance to statewide uniform regulations has been encountered. Smaller towns have shown little enthusiasm for converting their uncovered and burning dumps into sanitary landfills, and the four cities with offending incinerators are reluctant either to make recommended corrections or to build new plants. An account of these difficulties in the nation's first program incorporating statewide uniform air quality may be useful to those contemplating the formation of regional control organizations.

123. Degler, Stanley. State Air Pollution Control Laws. rev. ed. Washington, D.C., Bureau of National Affairs, 1970. 93 p.

A digest of air pollution control laws in each of the 50 states, Washington, D.C. and Puerto Rico, and the cities of Chicago, Detroit, New York, Philadelphia and Pittsburg. This revised edition of a work first published in 1969 contains a special analysis of the California Pure Air of 1968, as amended. The full text of the model State Air Pollution Control Law, as proposed by the Council of State Governments, is also included.

124. Delogu, Orlando E. "Legal Aspects of Air Pollution Control and Proposed State Legislation for Such Control." Wisconsin Law Review, no. 3, 1969, pp. 884-907.

Recognizing the difficulty of the air pollution predicament, a statute is offered that presents a comprehensive governmental regulatory scheme and underscores the need for a partnership of government and industry in order to control pollution.

125. Fireside, Lynn. "Is Creating Awareness of Air Pollution Enough?" Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn., June 23-27, 1968, 14 p.

Most air pollution control divisions, if they are aware of their responsibility to the public, have a public information program which relies largely on publicity techniques. The St. Louis County Community health education program on air pollution that involves the individual citizen is discussed.

126. Gartner, Irvin. "Levels of Program Development of Regional, State and Local Air Pollution Control Agencies." Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn., June 23-27, 1968, 35 p.

Preliminary findings are presented from a nationwide study concerning (1) what are the current conditions of regional, state and local air pollution control agencies in actual development and implementation of their respective control programs, and (2) the relative causal relationships of occupational and other "manpower" group to current levels of development.

127. _____. "Staff Salaries in Pollution Control Agencies." J. Air Pollution Control Association, v. 18, no. 9, September 1968, pp. 570-585.

"Based on the author's nationwide survey of salaries in mid-1967 from 118 state and local APC agencies with 1668 positions, this paper comparatively analyzes the results with pertinent occupations in major national salary surveys by the Bureau of Labor Statistics, National Science Foundation, the National Society of Professional Engineers, and College Placement Council. This baseline comparative investigation indicates agency salaries are significantly lower than pay levels of the competition in today's labor market. These conditions are compounded by the disadvantage of comparatively small organizational size with consequent limitations on individual opportunities for growth and recognition."

128. Gaulding, C. L. "Definition of Air Quality Control Regions; Approach and Experience to Date." J. Air Pollution Control Association, vol. 18, no. 9, September 1968, pp. 591-595.

Section 107 (A)(2) of the Clean Air Act, as amended by the Air Quality Act of 1967, directs the Secretary of the Department of Health, Education, and Welfare to designate Air Quality Control Regions for the purpose of establishing ambient air quality standards required in subsequent sections of the act. This paper gives a status report on the steps taken by the National Air Pollution Control Administration to implement this section in the seven months since the Air Quality Act was signed. It discusses the procedural aspects of the Administration's approach, emphasizing administration policy and the involvement of state and local entities in the development of region designations.

129. _____. "Regional Approach to Air Pollution Abatement Gains Momentum." Environmental Science and Technology, vol. 3, no. 5, May 1969, pp. 431-434.

Progress in dealing with air pollution is evidenced by the acceptance of the concept of air quality control regions. The procedure being followed by the National Air Pollution Control Administration for designating control regions is based on diffusion modeling. By mid-1970, more than 57 air quality control regions will be designated to protect 57 percent of the U.S. urban population from air pollution.

130. Green, Lewis C. "State Controls of Interstate Air Pollution." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 315-330.

The author contends that efforts should be made to develop a more effective scheme for interstate air pollution control compacts to prevent a centralized federal system from becoming a necessity.

131. Griswold, S. Smith. "Case Study: Los Angeles Battles the Air Trap." Public Management, vol. 49, April 1967, pp. 84-89.

The severity and frequency of air pollution in Los Angeles is caused by the nature of its transportation and industrial facilities, the tremendous growth of the city combined with the unique situation of the local meteorology. The author discusses how one local government generally in the forefront of air pollution control among municipalities, has dealt with its particular problems.

132. _____. "The States and Air Pollution." State Government, vol. 43, no. 3, Summer 1970, pp. 147-151.

The author reviews the performance of the states in handling air pollution problems since the 1967 amendments to the 1963 Clean Air Act. Although the states were charged with the primary responsibility in air pollution control, they were not prepared to carry out this task. The author discusses the complexities of the new legislation, the obstacles to enforcement action at the state level, and the limited progress now being made.

133. Hagevik, George H. Decision-Making in Air Pollution Control: A Review of Theory and Practice, with Emphasis on Selected Los Angeles and New York City Management Experiences. New York, Praeger, 1970. 217 p.

Direct regulation, due to its popularity with administrators and the fact that it allows for regulation under uncertainty, is shown to be an approach that will be widely used even though its adoption will mean higher costs in the long run. The case studies and review of the literature provide the basis for a decision model in air quality management that gives major emphasis to dealing with uncertainty.

134. Harris, Robert L., Jr. "Air Pollution Control Program Grants." Paper presented at the American Bar Association, National Institute Meeting on Federal Urban Grants: Policies and Procedures, Washington, D.C., October 3, 1969. 16 p.

The major program grant activity of the National Air Pollution Control Administration is outlined in Section 105 of the Clean Air Act. This section authorizes the Department of Health, Education and Welfare to make grants to air pollution control agencies for planning, developing, establishing, or improving programs for the prevention and control of air pollution.

135. "Illinois Moves Along in Fight for Clean Air; Legislative Study Committee Recommends Air Quality Standards." Environmental Science and Technology, vol. 3, no. 4, April 1969, pp. 319-320.

The Joint Air Pollution Study Committee, a legislative committee of the Illinois General Assembly, began work in 1967. It has issued a final report calling for the following courses of action: establishment of a Department of Environmental Pollution Control; abolishment of the present nine-member Air Pollution Control Board; appointment of a superintendent of air pollution control; and endorsement of nine recommendations for air quality standards.

136. "Incinerator Air Pollution; Facing the Problem Will Be Costly for Cities Whether Plant Is in Use or on Drawing Boards." Nation's Cities, vol. 7, no. 9, September 1969, pp. 23-27.

Approximately 350 city-owned incinerators have to be remodeled to meet new federal air pollution restrictions and new ones have to be designed with sophisticated air pollution control devices.

137. Johnson, Donald R. "State and Local Regulation of Air Pollution: Development of Air Pollution Control Programs by Local Health Departments." Popular Government, v. 33, February 1967, pp. 7-10.

"County health departments in North Carolina have assumed a role of leadership in the development of local air pollution control programs. This foresightedness may well help to prevent in this state the serious air pollution problems that currently threaten the health of citizens in many communities across the nation."

138. Lewin, Stuart F., Alan H. Gordon and Channing J. Hartelius. Law and the Municipal Ecology: Air, Water, Noise, Over-population. (NIMLO Research Report no. 156.) Washington, National Institute of Municipal Law Officers, 1970. 243 p.

Each of the four areas of pollution is discussed in a separate section of the book. "The typical polluter has little self motivation to clean up. Law must supply the missing incentive." Legal solutions in air pollution control are proposed and various existing programs are discussed listing specific cases.

139. Lieber, H. "Controlling Metropolitan Pollution through Regional Air-sheds: Administrative Requirements and Political Problems." J. Air Pollution Control Association, v. 18, no. 2, February 1968, pp. 84-93.

The regional approach to air pollution control is evaluated in the light of the New York metropolitan experience and recent federal and state legislative developments. The political difficulties involved in establishing and managing regional control centers are also discussed.

140. Loquercio, Peter A. and William J. Murphy. "How an Effective Permit System Works." Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn., June 23-27, 1968, 24 p.

The controversial subject of the relative merits of a permit system in the field of air pollution control is discussed. Details are given describing how a successful permit system in Chicago is being routinely applied for registering and regulating all air pollution sources.

141. Lunche, Robert G., Eric E. Lemke, and Julien A. Verssen. "Administration of a Permit System." Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn. June 23-27, 1968, 31 p.

Los Angeles has a two-step permit system requiring: 1) an authorization to construct prior to installation and 2) a permit for operation. The permit system has proved to be one of the most effective tools in reducing air pollution from stationary pollution sources. It not only prevents operation of equipment which emits air contaminants in excess of that allowed by law, but prevents the installation or construction of such equipment. Dependence on unreliable voluntary cooperation is replaced by a more certain system which places the same requirements on all applicants. The system is described in detail.

142. McCabe, L. C. "Can One State's Code Solve Another State's Problems?" Environmental Science and Technology, vol. 4, no. 3, March 1970, pp. 210-213.

Since publication of criteria for particulates by the Department of Health, Education and Welfare, many inquiries have been received regarding the Los Angeles mass-rate formula and table. However, a review of the development and application of Rule 54 leads to this conclusion: in no instance is the adoption of regulation of one enforcement agency by another justified, unless such regulations are thoroughly understood and it is determined that they are applicable to the problem in question. Each community should tailor its approach to its own needs and capabilities.

143. Maga, John A. "Considerations in Establishing Ambient Air Quality Standards." J. Occupational Medicine, vol. 10, no. 8, August 1968, pp. 408-413.

Some of the factors to be considered in the establishment of air quality standards by governments are the purposes and uses of such standards, the degree of understanding regarding the effects of pollutants on the environment, and the existence of usable data on the concentration of contaminants in the ambient air. A distinction is drawn between air quality standards and air quality criteria on which they are based, as well as between air quality standards and emission standards which serve as the direct basis for control.

144. Metzler, Dwight F. "States Co-operate to Fight Air Pollution." Royal Society of Health J. (London), vol. 88, no. 2, March-April 1968, pp. 75-78.

The Mid-Atlantic States Air Pollution Compact is described, along with an historical review of previous regional efforts to solve air pollution problems. A commission created by the compact will consist of the governors of the signatory states, ex-officio, and one commissioner to be appointed by the President of the United States.

145. Middleton, John T. "Quality Criteria." J. Occupational Medicine, vol. 10, no. 9, September 1968, pp. 535-538. (Presented before the Air Quality Criteria Symposium, June 4 and 5, 1968.)

Air quality criteria give us a chance to evaluate the scientific evidence of the effects of air pollution. Pollutants are not readily discernible to our senses and their effects are often so gradual that the connection between cause and effect may not be apparent to an untrained observer. The steps taken in developing air quality criteria are outlined. The sulfur oxides criteria, issued in March 1967, are being re-examined since the act requires the re-evaluation of all criteria issued before the act.

146. Miller, Gail, "Can Pittsburgh Enjoy Prosperity Without Pollution." City, vol. 4, no. 1, June/July 1970, pp. 32-34.

Pittsburgh's long history of attempts to clean its air is reviewed. Particular attention is paid to a new set of air pollution control regulations which went into effect in early 1970. A major section of the new regulations provides for heavy penalties for noncompliance.

147. "A Model Interstate Compact for the Control of Air Pollution." Harvard Journal of Legislation, vol. 4, June 1967, pp. 369-398.

Although compacts may or may not concern matters within the federal jurisdiction, the Constitution requires congressional approval to all compacts and agreements. The proposed model compact is derived from the Indiana-Illinois Compact which was enacted by those states in 1965.

148. Myers, Frank. "Nonsense and Niggardliness Are Undermining Pollution Control." Modern Manufacturing, vol. 1, no. 4, September 1968; pp. 184-190.

Although federal and local governments have enacted legislation for air and water pollution abatement, they ignore wastes discharged from their own facilities, which are many times greater than the volumes issuing from factories and plants. The state of New Jersey and the Metropolitan Sanitary District Commission of Greater Chicago are discussed as examples.

149. New York (City) Mayor's Task Force on Air Pollution. Freedom to Breathe. Report of the Mayor's Task Force on Air Pollution in the city of New York, New York, May 1966. 175 p.

Among the report's recommendations: creation of an Environmental Control Board for combating all major environmental hazards, not only air pollution; enforcement of air pollution laws by agency-imposed and -administered penalties; use of tax incentives for accelerating the installation of pollution control equipment. The report makes specific recommendation for controlling exhausts from buses and other city vehicles and it identifies the city government itself as the worst violator of its own laws.

150. . Evaluation of the Department of Air Resources since the Completion of the Report of the Mayor's Task Force on Air Pollution in 1966. New York, October 1969. 15 p.

The establishment of the Environmental Protection Control Board is recorded. Stricter policing of air pollution offenses has resulted in increased fine collection. The city has also applied air pollution abatement procedures on a number of its own installations and facilities. The report stresses the importance of controlling the automobile produced air pollution.

151. Purdom, Paul W. "Administration of Air Pollution Control Programs within the State Government." American Journal of Public Health, vol. 57, no. 2, February 1967, pp. 281-286.

Practice in states varies from Arkansas, where the state laws prohibit local air pollution control agencies, to other states, such as Colorado and Ohio, where authority to control sources of air pollution is vested in cities and counties.

152. "Reorganizing to Fight Urban Pollution." Environmental Science and Technology, vol. 2, no. 7, July 1968, pp. 504-509.

Establishment in New York City of the Environmental Protection Administration as the organization to deal with the city's pollution problems should result in more effective control measures. The head of EPA discusses the problems of air pollution, water pollution, and sanitation in the city that must be dealt with, the organization of EPA and the new agency's immediate plans.

153. Rossano, August T., Jr., Theodore H. Moller, and Herbert T. Dalmat. "Nationwide Air Pollution Control Training Efforts: Status Quo vs. Needs." J. Air Pollution Control Association, vol. 18, no. 3, March 1968, pp. 181-2.

Brief review of the historical development of U. S. air pollution training activities. It describes the training programs currently available as well as the level of financial support and the number of individuals enrolled in these programs. The article concludes with an outline of future needs in terms of changes in existing training programs, extension into new areas, and the critical problem of recruitment of qualified candidates for training.

154. Savas, E. S. "Feedback Controls on Urban Air Pollution." IEEE Spectrum, (Institute of Electrical and Electronics Engineers), vol. 6, no. 7, July 1969, pp. 77-81.

Given adequate meteorological and air quality measurements that indicate expected levels of pollutant concentrations a day or two in advance, the local control agency can issue directives for localized emergency control measures during the earliest stages of anticipated major and minor pollution episodes.

155. Scholderer, J. B. "Air Pollution Control." Fueloil, Oil Heat, vol. 28, no. 8, August 1969, pp. 58-62.

The New Jersey Air Pollution Control Code is reviewed briefly. The code provides that the governor of New Jersey can proclaim an air pollution emergency at which time all sources of pollution must immediately reduce emissions to the minimum.

156. Schueneman, J. J. "Local, Regional and State Air Pollution Control." Proceedings of the American Society of Civil Engineers, J. Sanitary Engineering Division, v. 93, December 1967, pp. 65-71.

Some aspects of governmental agencies concerned with the regulation of air pollution are presented. The activities of these agencies are usually referred to as air pollution control, air quality control, air resource management, or air conservation programs. The basic objective of these programs is to ensure that the health of the public will not be adversely affected by air pollution.

157. _____. "Organizational and Operational Techniques for Relieving Manpower Shortages in Air Pollution Control Agencies." J. Air Pollution Control Association, vol. 17, no. 10, October 1967, pp. 670-672.

Techniques which may be used to relieve manpower shortage are discussed in terms of (1) collaboration between state and local agencies, (2) organizational structures which make maximum use of scarce categories of people, (3) program policies which conserve the time of agency staff, (4) operating schemes which save travel time and minimize the skills required; and (5) working tools that can be used to get greatest production with the available personnel.

158. Seymour, Whitney North. "Cleaning Up Our City Air: Proposals for Combating Air Pollution through Affirmative Government Action Programs." Urban Affairs Quarterly, vol. 3, no. 1, September 1967, pp. 34-45.

The author maintains that the effort of government to control air pollution by regulation and enforcement has never been wholly successful. Not only is the penal system approach for bringing about compliance with air pollution standards a generally unsatisfactory way to engineer cooperation, because of considerable enforcement problems, it is also hypocritical since government itself is frequently a major violator. New, imaginative pollution control approaches by government must be encouraged.

159. Sokolow, Alvin D. AB 357: The Passage of California's "Pure Air" Law in 1968. Davis, Institute of Governmental Affairs, University of California, November 1970. 22p.

When the California legislature passed this law it established a new precedent in the environmental control politics. Most innovation in this and other areas of domestic public policy in the United States occurs at other points in the federal system-- in the national government, in state executive branches, and in individual cities and regions. As a strong regulatory program initiated almost completely by a state legislature, the 1968 California legislation is unique. The legislation dealt with motor vehicle emissions, setting minimum standards for the discharge from internal combustion engines.

160. Staisey, Consuelo E. "A History of Smog Control Legislation" in: Associated Students of the California Institute of Technology, An Educational Experiment in Self-Direct Research, Summer 1968, Pasadena, California, 1968, pp. 137-56.

The activity of California state and local governments with respect to abatement of smog in the Los Angeles area is reviewed, beginning in 1953, the first year of state action, and extending to the Pure Air Act of 1968.

161. "State Regulations." Chemical Engineering, vol. 77, no. 9, April 27, 1970, pp. 23-36.

"Almost every state has enacted pollution control legislation. In addition, many areas are controlled by regional, county, or city regulations. The summary here of basic state laws is useful in making a quick check of pollution codes."

162. "States Are Key in Pollution Abatement." Environmental Science and Technology, vol. 3, no. 3, March 1969, pp. 223-228.

With their constitutional authority and the unique resources at their disposal, states appear to be in a favored position for dealing with pollution. The states' earliest involvement in pollution control was in water. Air pollution control activity has been more recent. The effect of the Clean Air Act has been to prod states into action by giving the federal government a role in control of both interstate air pollution abatement, and by providing grants for workable programs. Some of the state programs are discussed and the fiscal 1967 grants for pollution control programs are tabulated.

163. "The States, Playing a Crucial Role in Environmental Management, Try a Variety of Innovations in 1970." CF Letter (Conservation Foundation), no. 11, November 1970, pp. 1-12.

To illustrate some recent trends in air pollution control at state government level, a sampling of new laws is provided. Specifically, land use regulation, agency reorganization, right to sue and truth-in-pollution are discussed.

164. "Strong Air Pollution Control Policy." J. Air Pollution Control Association, vol. 18, no. 8, August 1968, pp. 505-506.

A policy statement by the National Society of Professional Engineers states that regulatory action should be the primary responsibility of state and local governments.

165. Tri-State Transportation Commission. Managing the Natural Environment; a Regional Plan for Water, Sewage, Air and Refuse. New York, March 1970, 38p.

The section of this report dealing with air suggests a spectrum of possible actions available for public consideration: control of vehicular emissions, prohibition of gasoline-powered vehicles selectively or everywhere, prohibition of high-sulfur fuels or regulation of such emission on a regional basis, regional control of incinerator emissions, establishment of regionally acceptable limits of pollutants, etc.

166. U. S. National Air Pollution Control Administration. Manual for the Development of State Recommendations for Air Quality Control Regions. (Washington, D. C.), January 1970. 21p.

The purpose of this manual is to outline the process by which states on their own initiative can recommend to the National Air

Pollution Control Administration boundaries for air quality control regions within their jurisdiction. The Secretary of the Department of Health, Education, and Welfare is directed by the Clean Air Act, as amended, to designate air quality control regions to set in motion the machinery for regional air pollution control. The establishment of such regions to this point has been the result of federally initiated action.

167. Venezia, Ronald A. "Control of Air Pollution from Federal Facilities." Paper presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minn., June 23-28, 1968, 15p.

"It is the federal government's intent to be exemplary in controlling air pollutant emissions from its facilities. Each agency has surveyed its facilities to define the air pollution problem and solutions have been proposed to be implemented in a government-wide 5-year program. This program is subject to updating and review each year."

168. Warren, David G. "State and Local Regulations of Air Pollution." Popular Government, vol. 33, no. 5, February 1967, pp. 1-6.

Exploration of the legal background and development of modern air pollution regulations are discussed. The choices and alternatives for present and future air pollution control are numerous and not seriously restricted by legal considerations. The role of the private sector in air pollution control-- industry, commerce and the scientific community-- is not discussed, but the state, local and federal government role is.

4. LAND USE CONTROLS

169. Bunyard, F. L. and J. D. Williams. "Interstate Air Pollution Study of the St. Louis Area Air Pollutant Emission Related to Actual Land Use." J. Air Pollution Control Association, vol. 17, no. 6, 1967, pp. 215-219.

This report, based on data gathered in 1963-1964, is principally concerned with three land-use categories: residential, institutional and commercial, and industrial. The emission sources considered are: power generation, fuels used for space heating, solid waste disposal, and industrial processes.

170. Davies, J. Clarence, III. "Compliance" in: The Politics of Pollution. New York, Pegasus, 1970, pp. 176-192.

Discussing preventive action, the author points out that planning and zoning controls can also be used effectively to prevent both air and water pollution. More research is called for on ways in which planning techniques can be utilized.

171. Electric Power and the Environment: A Report Sponsored by the Energy Policy Staff, Office of Science and Technology, in Cooperation with Atomic Energy Commission, Department of HEW, Department of the Interior, Federal Power Commission, Rural Electrification Administration, Tennessee Valley Authority, Council on Environmental Quality. Washington, U. S. Govt. Print. Off., August 1970. 71p.

A recommendation that government, industry and the public cooperate in the long-term planning and location of new electric facilities to lessen the damage of power plant pollution, either materially or aesthetically, on the environment. Government licensing powers should be increased and an expanded research program should be jointly adopted by government and industry so as to ensure the proper land use planning for power plants in the future.

172. Fletcher, R. H. "Kitimat Pollution Control By-Law." Pulp and Paper Magazine of Canada, (Quebec), vol. 71, no. 7, April 3, 1970, pp. 78-90.

Land use in the 16-year-old town of Kitimat, B. C., was planned to minimize the conflicts that can exist between residential areas and industry. To preserve the quality of its environment, the town passed a waste emission by-law that requires the monitoring of selected emissions from its pulp mill and smelter. The law, to become effective in December 1970, identifies a tolerable level of pollution which is expected to be met, but not exceeded, by the two industries.

173. Hosler, Charles L. "Air Pollution and Plant Location." Appalachia, vol. 3, no. 9, June-July 1970, p. 3.

Pollution may be a traditional by-product of prosperity, but it is not a necessary one. Engineering and physical chemistry can help reduce pollution caused by industrial processes, and wise land use planning for the location of industrial facilities can contribute to minimizing the impact of pollution that is produced.

174. "Land Use Regulation." CF Letter (Conservation Foundation), no. 11, November 1970, pp. 2-4.

State governments are trying to re-establish their control over the use of their lands. Vermont and Maine are, among others, two states that have enacted laws regarded as a form of statewide zoning. The Vermont law created an Environmental Board and nine District Environmental Commissions appointed by the governor. Permit applications must be filed with the commissions by anyone wishing to construct a subdivision or development covered by the law and the commission must find that the project meets 10 criteria, one of which is that it must not cause "undue" air or water pollution.

175. Leduc, Edgar C. "Effect of Area on Air Pollution Control Programs - Appendix 9" in: Center for Air Environment Studies, Pennsylvania State University, Politics of Resource Use in Local Government Policy and Programs. University Park, Pennsylvania, November 30, 1968. 15p.

The methodological aspects of investigating the political determinants of resource use on a local level are discussed. The report stresses the increasing importance of local government decisions concerning the use of land and analyzes the effects of the democratic political process on pollution control programs.

176. Rydell, C. P., and G. Schwarz. "Air Pollution and Urban Form: a Review of Current Literature." J. American Institute of Planners, vol. 34, no. 2, March 1968, pp. 1-6.

An urban air pollution problem is caused by the overall spatial and temporal arrangement of the urban elements (smoke stacks and automobiles) causing the pollution. The designing of buildings and streets, the location of industrial sites, the transportation of people and goods, the allocation of open space, the planning of land use, and the planning of air use are discussed in order to alleviate or minimize the contributions of city structure to air pollution.

5. PRIVATE LEGAL ACTION

177. "Air Pollution as a Private Nuisance." Washington and Lee Law Review, vol. 24, 1967, pp. 314-319.

Article reviews the three basic theories upon which an action for air pollution nuisance can be predicated: the absolute nuisance rule, the Restatement of Torts rule, and the doctrine of the Rylands v. Fletcher case.

178. Baldwin, Malcolm and James K. Page, Jr. (eds.). Law and the Environment. New York, Walker, 1970, 392 p.

Papers from a 1969 conference sponsored by the Conservation Foundation assessing legal techniques for protecting and enhancing the quality of the environment. Among other things, this survey of existing law points out the complexities of environmental litigation.

179. Cohen, J. L. "Interstate Compacts - An Evaluation." J. Air Pollution Control Association, vol. 17, no. 10, October 1967, pp. 676-678.

Discussion of the development of interstate compacts and legal and constitutional principles as they apply, as an effective legal mechanism for the purpose of evaluating compacts, to joint action on an interstate basis to control air pollution.

180. D'Amato, Anthony A. "Environmental Degradation and Legal Action." Bulletin of the Atomic Scientists, vol. 26, no. 3, March 1970, pp. 24-26.

The role of private legal initiative in combating environmental degradation is explored. The basic difficulty with a lawsuit against an air or water polluter, or a proposed new airport or other installation, is that it does not fit the customary pattern of lawsuits. "Public interest litigation" can be instituted, however, and some examples of such actions are presented.

181. Delogu, Orlando E. "Legal Aspects of Air Pollution Control and Proposed State Legislation for Such Control." Wisconsin Law Review, vol. 1969, 1969, pp. 884-907.

The author offers a model air pollution statute, "not with view that perfection has been attained, but in the hope that it will provide fruitful discussion leading to additions and revisions which will in fact achieve the desired controls." The statute presents a comprehensive governmental regulatory scheme and it also underscores the need for a partnership of government and industry in order to control pollution.

182. "Equity and the Eco-System: Can Injunctions Clear the Air?" Michigan Law Review, vol. 68, May 1970, pp. 1245-1293.

The article reviews the elements of an injunction action and suggests how they may successfully be established against an individual air polluter. While recognizing that legislative action is necessary to accomplish widespread air pollution control, the author suggests that injunctions serve several valuable functions: to alleviate the harm caused by some form of industrial air pollution, to serve as a catalyst for a more widespread legislative response, and to provide publicity.

183. Farrell, Richard J. "Let the Polluter Beware." Case and Comment, vol. 75, no. 5, September-October 1970, pp. 3-8.

Directing his comments to representatives of industry, Mr. Farrell outlines the trends in pollution legislation and judicial decisions and suggests that industry must attune its outlook to these new interpretations of the law and learn how to live with them.

184. "Freeways vs. Contamination Control in California." Contamination Control, vol. 9, no. 4, April 1970, pp. 14-16, 34.

The first legal case in history to involve contamination control of infiltrated dust into an industrial plant from the building of a freeway is discussed. The suit was based on the contention that the building and use of the freeway would introduce an intolerable level of particulate and gaseous matter which would seriously affect the manufacture and assembly of capacitors, switches, relays, and cables. The suit involves a cost-to-cure settlement request of about one million dollars.

185. Gray, Oscar S. Cases and Materials on Environmental Law, Washington, D.C., Bureau of National Affairs, 1970, 1252 p.

Legislative, administrative and judicial processes and cases in environmental legislation are reviewed in this handbook.

186. Juergensmeyer, Julian C. "Control of Air Pollution through the Assertion of Private Rights." Duke Law Journal, vol. 1967, 1967, pp. 1126-1155.

Assertion of private rights is generally not effective for achieving air pollution control. The control consequences of private actions are at best piecemeal and are dependent upon the willingness and financial ability of individuals to go to court. However, the author contends that the legal actions of nuisance, trespass, and negligence, if applied by jurists impressed with the importance of air pollution control, may provide some redress for damages caused by air pollution and, from the standpoint of society as a whole, may handle some instances of air pollution which cannot be or are not yet controlled by public regulation.

187. Miller, Leonard A. and Doyle J. Borchers. "Private Lawsuits and Air Pollution Control." American Bar Association Journal, vol. 56, May 1970, pp. 465-469.

The authors contend that the private tort action and governmental regulation must be part of a total control effort, complementing rather than supplanting one another. To foster the efficacy of private actions, it is suggested that documents developed by NAPCA can give content to legal action in three basic ways: 1) to make it easier to assess the damage caused by air pollutants; 2) to ease the difficulty of determining the standard of care required of an industry and 3) to provide new information to place on the scales of the judicial weighing process (the "balancing of the equities").

188. Morse, Anita L. and Julian C. Juergensmeyer. "Air Pollution Control in Indiana in 1968: a Comment." Valparaiso University Law Review, vol. 2, no. 2, Spring 1968, pp. 296-314.

Prior to the passage of the Air Quality Act of 1967, Indiana had an Air Pollution Control Board constituted under the Indiana Air Pollution Control Law whose effectiveness was minimal. Under the new federal law an immediate and total revision of the present Indiana law is necessary. This article deals with the implications of such revision as they pertain to the rights of individuals to take legal action against air pollution and to problems in the drafting and implementation of control statutes.

189. Platt, Rutherford H. "Towards Constitutional Recognition of the Environment." American Bar Association Journal, vol. 56, November 1970, pp. 1061-1064.

Assuming that an environmental amendment to the Constitution is desirable, the author discusses whether this should take the form of a precatory statement or a new set of ground rules. He also refers to actions taken by individual states to protect the rights of their citizens to a better environment.

190. Pollack, Lawrence W. "Legal Boundaries in Air Pollution Control - State and Local Legislative Purpose and Techniques." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 331-357.

The varied and technical nature of air pollution has caused legislatures to adopt multiple and varying legal techniques in an attempt to achieve realistic control. Experience has shown that most carefully drafted public health related control techniques are within legal boundaries established by the U. S. Constitution.

191. Prosser, William L. "Private Action for Public Nuisance." Virginia Law Review, vol. 52, October 1966, pp. 997-1027.

In order for an individual to obtain redress for a public nuisance he must prove that he has suffered some "special" or "particular" damage. This article inquires into the nature of the particular damage which will satisfy this requisite to private recovery.

192. Rheingold, Paul D. "Civil Cause of Action for Lung Damage Due to Pollution of Urban Atmosphere." Brooklyn Law Review, vol. 33, 1966, pp. 17-33.

The paper indicates that there is a possibility of recovery in tort for lung injury attributable to air pollution. It envisions as plaintiff a person who has inhaled a combination of pollutants, over a wide range of both time and space, and attempts to identify who the potential defendants would be in such a suit, what theory of legal liability could be employed, and how to show proximate cause between the air pollutant and the particular disease.

193. Sax, Joseph L. "Emerging Legal Strategies: Judicial Intervention." in: The American Academy of Political and Social Science, Society and Its Physical Environment (Annals, vol 389, May 1970), pp. 71-76.

Though not dealing specifically with air pollution problems, the article concludes: "Citizen-initiated environmental litigation is a response to the inability of traditional administrative agencies to accommodate to newly recognized ecological perspectives in the management of natural resources." The courts are sought out as an instrumentality whereby complaining citizens can obtain access to a more appropriate forum for decision-making.

194. Sive, David. "Some Thoughts of an Environmental Lawyer in the Wilderness of Administrative Law." Columbia Law Review, vol. 70, April 1970, pp. 612-651.

The article discusses judicial review of administrative rulings on questions involving environmental law. Particular attention is paid to the limitations upon judicial review imposed by the "substantial evidence" rule. The author contends that an easing of this limitation would make more "drastic" environmental improvement proposals unnecessary.

195. "Toward a Constitutionally Protected Environment." Virginia Law Review, vol. 56, April 1970, pp. 458-486.

The article postulates that a constitutional right of environment can be recognized and it examines the theories that could justify recognition of such a right. Jurisprudential hurdles that might obstruct its effective vindication are also discussed.

6. COST SHARING

196. Cost Sharing with Industry? Revised Summary Report of the U.S. Working Committee on Economic Incentives. Washington, D.C., Nov. 1967, 36 p.

The report concludes that additional pollution control costs are of manageable proportions for almost all manufacturing firms. To those few firms adversely affected by pollution control costs, the federal government already provides considerable assistance, especially in the area of R&D. Further assistance should be selective and should be directed toward helping individual cases of hardship rather than toward benefiting an industry as a whole.

197. Gerhardt, Paul H. "Incentives to Air Pollution Control." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 358-368.

There are two basic methods of controlling air pollution: either by offering incentives or by enforcing regulations. The author considers both policies and among incentives suggests that tax credits and write-offs for the installation of control equipment might be employed as partial cost subsidies. Present trends in the United States indicate greater use of regulation than of direct cost-sharing incentives.

198. McKee, Herbert C. "Preferential Tax Treatment for Pollution Control Expenditures: Engineering Considerations." J. Air Pollution Association, vol. 18, no. 9, September 1968, pp. 596-599.

Preferential tax treatment has been advocated as a means of reducing the cost to industries for installation of air and water pollution control equipment. Most of the present or proposed laws apply only to filters, scrubbers, precipitators, and other supplementary devices for pollution control, but do not apply to process modifications which prevent pollution problems and make such supplementary devices unnecessary. Therefore, the long-term effect of preferential tax rates may be to increase the total cost of producing various manufactured items. Such rates may also act to subsidize process changes which enhance a company's competitive position in the industry. Such rates may also be undesirable from the standpoint of conserving natural resources. Specific examples are given to illustrate these considerations.

199. Wilson, Douglas B. "Tax Assistance and Environmental Pollution." Tax Policy, vol. 37, no. 7-8, July-Aug. 1970, pp. 3-11.

An examination of present federal assistance and of the case both for and against providing additional assistance. Believing that an increase in cost subsidies would prove ineffective, the author notes alternative policies and suggests that a system of emission charges should be tested in air pollution control programs on an experimental basis.

200. Wilson, Richard D. and David W. Minnotte. "Government/Industry Cost-Sharing for Air Pollution Control." J. Air Pollution Control Association, vol. 19, no. 10, Oct. 1969, pp. 761-766.

The effect of existing government programs of special across-the-board tax allowances for air pollution control equipment is discussed. The analysis shows that current federal aid can amount to as much as 59 percent of total pollution control costs. Typical bills introduced in Congress would increase the amount to about 65 percent. The authors conclude that in general additional partial cost subsidies of this nature are neither necessary nor desirable, although help for specific industries might be warranted.

7. ECONOMIC INCENTIVES

201. Anderson, R. J. and T. D. Crocker. "The Site Value Approach to the Measurement of Economic Losses Due to Air Pollution." Paper presented at the Annual Meeting of the Air Pollution Control Association, New York, June 22-26, 1966. 15p.

Using data from both metropolitan and agricultural areas, this investigation confirms that air pollution and site values are negatively related. Although considered one of the more promising methods of estimating economic losses, the site value approach has disadvantages. In particular, it does not cover fundamental processes of adjustment which can result from the impact of air pollution.

202. Babcock, Lyndon R., Jr. "A Combined Pollution Index for Measurement of Total Air Pollution." J. Air Pollution Control Association, vol. 20, no. 10, October 1970, pp. 653-659.

A method for estimating overall air pollution is described. Under this approach the formulators of pollution control policy would be able to trade off one pollutant against another, always being aware of the effect of a change in one pollutant level on overall air quality.

203. Brown, Alan K. "Financing Quality." Municipal Civic Review, vol. 59, no. 10, November 1970, pp. 525-531.

"Total system, not just programs and money, is needed to assure victory in the pollution battle." In view of the cost magnitude and program scope of the environmental problem, a 10 percent long-term surtax on federal and corporate tax liabilities is proposed.

204. Burton, Ellison and William Sanjour. Evaluating the Efficiency of Urban Air Pollution Abatement Strategies. Washington, D. C., Ernst & Ernst, 1968, 17p.

A simulation approach which permits the cost-effectiveness of strategies for urban air pollution and abatement to be examined: a paper presented to the 15th International Meeting of the Institute of Management Science, Cleveland, Ohio, September 12, 1968.

205. Crocker, Thomas D. "Some Economic Aspects of Air Pollution Control." Natural Resources Journal, vol. 8, no. 2, April 1968, pp. 236-258.

The author develops an economic theory indicating that there is some evidence of the direct relationship between increased real per capita incomes and improved environmental quality.

206. Dolbear, F. T., Jr. "On the Theory of Optimum Externality." American Economic Review, vol. 57, no. 1, March 1967, pp. 90-103.

The author analyzes income effects associated with different distribution rights (e.g., the right to pollute) and shows that in the area of consumption externalities the existence of legal responsibility does affect the level of externality achieved in private bargaining among consumers.

207. Edmisten, Norman G. and Francis L. Bunyard. "A Systematic Procedure for Determining the Cost of Controlling Particulate Emissions from Industrial Sources." J. Air Pollution Control Association, vol. 20, no. 7, July 1970, pp. 446-452.

Air quality control program officials should consider the associated costs for various control strategies in their decision-making processes. A procedure for determining the costs of alternative air pollution control strategies is presented and discussed.

208. Ernst and Ernst. Applications of Cost-Effectiveness Analysis to Air Pollution Control, prepared for U. S. Department of Health, Education, and Welfare, Public Health Service, Consumer Protection and Environmental Health Service. Washington, D. C., April 1970. v.p.

The report discusses some cost-effectiveness techniques developed and applied to aid in the selection of air pollution control alternatives in several previous contract studies for the National Air Pollution Control Administration. Bringing together the cost-effectiveness concepts, methods, and results of these studies allows their utility as tools of air resource management to be more readily evaluated.

209. _____. Cost-Effectiveness Study of Air Pollution Abatement in the National Capital Area. Washington, D. C., January 1969.

Report presenting methods and results in developing cost estimates for achieving selected air quality levels in the National Capital area under different air pollution abatement strategies for stationary sources. The measures, strategies, and goals chosen for this study are only a few of many possibilities and, hence, provide results for only some of many possible questions. However, on the basis of a computer-assisted model developed to simulate the average annual concentration of two pollutants, it is suggested that the cost of the direct regulation strategy recommended by the Secretary of HEW at the conclusion of an abatement conference in the Washington metropolitan area would be approximately one hundred times as great as an alternative, least-cost, strategy.

210. Etheredge, Lynn, Dorian G. Lucey, and William Spector. "Cost Benefit Analysis--Planned and Projected," in: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968, Associated Students of the California Institute of Technology, Pasadena, 1968, p. 255-265.

Assuming an air pollution index can be established, this economic model for a cost-benefit analysis should make possible policy recommendations for smog control in the Los Angeles area. Currently available data suggesting an annual cost to residents of \$269 million are incomplete and further research in many areas is essential to provide a sound basis for policy decisions. The authors recommend a model of mixing and dispersion in the Los Angeles basin.

211. Gerhardt, Paul H., "Incentives to Air Pollution Control." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 358-368.

In his discussion of economic incentives that might be adopted to control air pollution, the author includes the possibility of making award payments to firms achieving and maintaining a given standard of performance.

212. Goldman, Marshall I., ed. Controlling Pollution: the Economics of a Cleaner America. Englewood Cliffs, N. J., Prentice-Hall, 1967. 175p.

Articles, primarily descriptive, emphasize the financial and social costs of pollution control. Partial contents include a discussion by E. S. Mills of economic incentives in air pollution control, and an account by T. O. Thackrey of how Pittsburgh deals with its air pollution problem.

213. Hagevik, George. "Legislating for Air Quality Management: Reducing Theory to Practice." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 369-398.

With a view to achieving practical results, the article points out bargaining as a way to finding a least-cost solution to providing air pollution control.

214. Herfindahl, Orris C. and Allen V. Kneese. Quality of the Environment: an Economic Approach to Some Problems in Using Land, Water and Air. Baltimore, Johns Hopkins Press, 1965. 96pp.

This study explores the use of economic analysis in relation to environmental problems. Substantial research gaps are especially likely in dealing with these problems because they require the simultaneous application of knowledge from natural science, engineering, and the social sciences. A suggested research strategy should involve such disciplines in building a "normative decision model," studying relationships and parameters specified in the decision model, applying the model and empirical information to actual case studies, and studying the appropriate institutional arrangements.

215. Jackson, W. E., H. C. Wohllers and W. DeCoursey. "Determining the Costs of Air Pollution Control." J. Air Pollution Control Association, vol. 19, no. 12, December 1969, pp. 917-923.

A six-step procedure is examined for estimating and reducing air pollution emissions within a metropolitan region. The procedure is illustrated for one stationary source in the Delaware Valley.

216. Kneese, Allen V. "Economic Responsibility for the By-Products of Production," in: The American Academy of Political and Social Science, Society and Its Physical Environment (Annals, vol. 389, May 1970), pp. 56-62.

The pollution of such "common property" resources as air and water is inherent in an economic system such as ours, where the central concepts governing resource allocation have historically been private property, freedom of exchange and competition. We are just starting to appreciate that residuals-management is not a question of isolated and individual controls but a large-scale and pervasive problem in the allocation of common property resources.

217. Mishan, E. J. The Costs of Economic Growth. London, Staples Press, 1967, 190 p.

The author maintains that the dichotomy between the traditionalists and the modernizers in the economy has served to confuse the chief issue that confronts us: "that of seeking to adjust the environment to gratify man's nature or of adjusting man's nature to an environment determined predominantly by 'efficiency considerations,' that is, by technological advance." Property rights are discussed and a new form of such rights, "amenity rights" to clean air and quiet surroundings are recommended.

218. Nourse, Hugh O. "Is there an Economic Solution to the Air Pollution Problem?" University of Illinois Bulletin, vol. 9, no. 5, Fall 1969, pp. 1-4.

The author maintains that even if the benefits from pollution control are greater than abatement costs, it may be preferable to handle pollution as a political question because the costs of measurement are so high.

219. O'Connor, John R. and Joseph F. Citarella. "An Air Pollution Control Cost Study of the Steam-Electric Power Generating Industry." J. Air Pollution Control Association, vol. 20, no. 5, May 1970, pp. 283-288.

The results of the National Air Pollution Control Administration's comprehensive survey of the cost of particulate control

in the steam-electric power generating industry are presented. Installation costs of precipitators for individual boilers are analyzed and are shown to vary widely; maintenance and operation are fairly constant for individual companies but vary from one company to another. Theoretical studies of the cost of pollution control are included.

220. Ramsey, Norman F. "The Chemistry and Cost of Contamination: We Need a Pollution Tax." Bulletin of the Atomic Scientists, vol. 26, no. 4, April 1970, pp. 3-5.

A pollution tax levied on a national scale could be the source of funds for pollution control and research.

221. Ridker, Ronald G. Economic Costs of Air Pollution: Studies in Measurement. New York, Praeger, 1967, 214 p.

This book is the outgrowth of a three-year study for the U.S. Public Health Service on the economic problems of air pollution. Air pollution, which results from using air as waste-disposal medium, is an example of an external diseconomy. In the absence of government action, and with no method of rationing clean air through private markets, air pollution reaches socially undesirable levels, thus imposing costs on others. The measurement of air pollution costs in this study is essentially exploratory, providing estimates wherever possible.

222. Sacco, John F. and Edgar C. Leduc. "An Analysis of the Effect of Social, Economic and Political Factors on State Air Pollution Expenditures." Paper presented at 61st Annual Air Pollution Control Association meeting, St. Paul, Minn., June 1968. 46 p.

A variety of air pollution policies, level of expenditures, type of activities, etc., in the fifty states is presented. This paper analyzes the extent to which expenditure variations are due to economic, social and political factors.

223. Smith, Dan Throop, "Improvement in the Quality of the Environment: Costs and Benefits." Tax Policy, vol. 37, no. 3-4, March-April 1970, pp. 3-11.

The author assumes that the need for large-scale and long-range environmental pollution control programs is generally accepted. Since these programs will entail substantial expenditures, it becomes necessary to consider program costs and how these costs may be borne. Three categories of costs, their nature and implications, are discussed: higher industrial costs reflected in higher prices, higher government costs reflected in higher taxes, and higher social costs reflected in more extensive government intervention.

224. Weber, Herbert J. "The Impact of Air Pollution Laws on the Small Foundry." J. Air Pollution Control Association, vol. 20, no. 2, February 1970, pp. 67-71.

The financial cost of complying with American and Canadian air pollution control laws is currently prohibitive for small iron foundries. The author provides a comparison of cupola melting costs and electric melting costs which demonstrates the problems facing gray iron foundries. He also describes researches directed toward the establishment of cheaper methods of cupola effluent control.

225. Weinrich, John E. "Strategic Cost-Benefit Factors in Environmental Performance." Public Utilities Fortnightly, vol. 81, no. 4, February 1968, pp. 32-38.

Cost-benefit analysis is suggested here as a mechanism for helping to resolve the conflicts between environmental performance and other priorities which public utilities are obligated to consider.

226. _____. "Strategies for Controlling Air Pollution." Public Utilities Fortnightly, vol. 81, no. 12, June 1969, pp. 80-84.

The application of cost-benefit analysis to air pollution control in electric power production provides a systematic way in which the alternatives can be examined, assessed, and juxtaposed for purposes of comparison and decision making.

227. Wilson, Richard D. and David W. Minnotte. "A Cost-Benefit Approach to Air Pollution Control." J. Air Pollution Control Association, vol. 19, no. 5, May 1969, pp. 303-308.

The destructive effects of air pollution present a formidable diseconomy in many communities. Before any regulatory procedure can be established an acceptable level of pollution must be defined. In order to do this, the authors present an analysis of the overall economic impact of air pollution on a community, and a method of balancing the cost of control with the benefits received from it. Application of this technique, they contend, will enable an acceptable level to be found for any given community.

228. Wolozin, Harold (ed.). The Economics of Air Pollution: A Symposium. New York, Norton, 1966. 318 p.

Results of a symposium including papers by Allen V. Kneese ("Air Pollution-General Background and Some Economic Aspects"); Edwin S. Mills ("Economic Incentives in Air-Pollution Control"); Leslie A. Chambers ("Risks, Versus Costs in Environmental Health"); Thomas D. Crocker ("The Structuring of Atmospheric Pollution

Control Systems"); Ronald G. Ridker ("Strategies for Measuring the Costs of Air-Pollution"); Edward T. Crowder ("The Use of Government Statistics in Air-Pollution Control"); Helen H. Lamale ("The Use of Consumer-Expenditure Data in Air-Pollution Control"); Lester Goldner ("Air-Pollution Control in the Metropolitan Boston Area; A Case Study in Public Policy Formation"); and Harold Wolozin ("Setting Criteria for Public Expenditures on Air Pollution Abatement: Theoretical Foundations and Limitations").

229. _____ . "The Economics of Air Pollution: Central Problems." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 227-238.

An attempt to evaluate the central problems economists have encountered in developing measures for the cost of air pollution to society. The author's central conclusions are: (1) "current estimates of total damage inflicted on this nation by air pollution are totally unreliable, and most experts. . . are pessimistic in their prognosis for more acceptable estimates; the difficulty of improved estimates stems "from the paucity of data and the primitive state of pollution measurement and control technology;" (3) "air pollution. . . is one of a number of interrelated problems affecting the quality of the environment; and (4) "there is no clear consensus on what kinds of economic measures should be taken to control pollution."

230. Woodcock, Kenneth R. and Larry B. Barrett. "Economic Indicators of the Impact of Air Pollution Control: Gray-Iron Foundries, A Case Study." Paper presented at the Air Pollution Control Association Annual Meeting, 62nd, New York, N.Y., June 22-26, 1969. 23 p.

The authors employ 14 indicators (financial, engineering, production effectiveness) to describe the direct impact of air pollution control expenditures on two gray-iron foundries. The indicators are also helpful in determining effective and equitable answer to the financial problems facing a particular plant in this connection, and can further be used to compare different plants in the same industry.

8. EMISSION CHARGES

231. Carlin, Alan. "The Implications of Geographic-Specificity for Air Pollution Abatement Strategy." Paper presented at the Symposium on Development of Air Quality Standards, Los Angeles, Calif., October 23-25, 1969.

An auction of air pollution permits to emitters for each critical pollutant in a given air basin appears to offer advantages over either the administrative or emission charge strategies if the geographic-specificity problem is ignored.

232. Cost Sharing with Industry? Revised Summary Report of the U.S. Working Committee on Economic Incentives. Nov. 1967. 36 pp.

The committee (one of several committees under the direction of the Federal Coordinating Committee on the Economic Impact of Pollution Abatement) recommended that the Secretary of HEW assess the effectiveness of existing federal assistance and that cost-sharing should be limited to individual cases of hardship. In view of the difficulties involved in setting and administering effluent and emission fees, further research should be carried out in demonstration projects and experimental programs.

233. Dales, J. H. "Land, Water, and Ownership." Canadian Journal of Economics, vol. 1, no. 4, Nov. 1968, pp. 791-804.

The historic absence of distinct property rights to water use has resulted in deterioration of water quality and neglect of water-use technology. To redress the present situation, Professor Dales advocates the establishment of a market system whereby the government issues limited rights to pollute which are freely transferable and thus self-regulating in price. Such a system would eliminate the need for cumbersome administrative machinery.

234. _____. Pollution, Property and Prices. An Essay in Policy-Making and Economics. Toronto, Ont., Univ. of Toronto Press, 1968. 111 p.

The author discusses problems of pollution with particular reference to economic aspects and proposes a simple scheme for establishing property rights in air and water and for obtaining the best allocation of the costs involved in controlling pollution.

235. "Effluent Charges Have Proven They Can Work" in: U.S. Congress, Senate, Committee on Public Works, Water Pollution - 1970; Hearings before the Subcommittee on Air and Water Pollution, April 1970 (91st Cong., 2d sess.), Washington, U.S. Govt. Print. Off., 1970, vol. 1, pp. 188-199.

Three examples are given of successful effluent charge systems: the largest and most successful is reported to be in the Ruhr Valley of Germany. The effluent charge approach is presented as simple — the less you pollute, the less you pay.

236. Gerhardt, Paul H. "Incentives to Air Pollution Control." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 358-368.

A system of emission fees has been used successfully to abate water pollution. The author discusses the difficulties inherent in any attempt to apply this system to air pollution.

237. Kneese, Allen V. and Blair T. Bower. Managing Water Quality: Economics, Technology, Institutions. Baltimore, Johns Hopkins, 1968. 328 p.

The authors suggest that effluent charges form an essential element in any management program inasmuch as they provide the most satisfactory economic incentive to achieve a desired level of quality at minimum cost. The incentive is continuous, prevails at all levels of wastes, provides revenue toward operation of the management system, and, while requiring more complete damage information than presently available, contains no more informational requirements than procedures based upon standards of regulation.

238. Ruff, Larry E. "The Economic Common Sense of Pollution." The Public Interest, no. 19, Spring 1970, pp. 69-85.

The author suggests that a price-based control mechanism be instituted. After an estimate of the social cost function for pollution, including the marginal cost associated with various pollution levels, is made, the cost of pollution abatement should be estimated. Under such a system anyone could emit any amount of pollution so long as he pays the price which the Pollution Control Board sets to approximate the marginal social cost of pollution. If pollution consists of many components, each with its own social cost, there should be different prices for each component.

239. U.S. Council of Economic Advisors. A Proposed Tax on Sulfur Dioxide. Washington, D.C., August 1970.

The council proposes a tax of \$45 a ton on the emission of sulfur dioxide, regardless of sulfur content in fuels. While controls and regulations might in the long run work, they require that the standards be set at economically achievable levels. The council suggests that a tax on sulfur dioxide emission would induce quicker results.

240. Wilson, Douglas B. "Tax Assistance and Environmental Pollution." Tax Policy, vol. 37, no. 7-8, July-August 1970, pp. 3-11.

Basing his conclusions on previous work with the federal government's Working Committee on Economic Incentives, the author is of the opinion that additional tax assistance would be ineffective and costly due to its multiple drawbacks. The author notes alternative policies and suggests that a system of emission charges should be tested in air pollution control programs on an experimental basis.

241. Wolozin, Harold (ed.). The Economics of Air Pollution. New York, Norton, 1966. 318 pp.

The authors contribute expert knowledge derived from several disciplines and experience, both theoretical and practical, to this discussion of the economics of air pollution control, research and policy formulation. The editor concludes that economics cannot be divorced from social, political and psychological considerations and that some economic aspects of the problem can only be coped with adequately if the traditional boundaries of economic science are transcended.

9. AIR POLLUTION CONTROL ABROAD

242. Adinolfi, G. "First Steps Toward European Cooperation in Reducing Air Pollution- Activities of the Council of Europe." Law and Contemporary Problems, vol. 33, no. 2, Spring 1968, pp. 421-426.

The Consultative Assembly of the Council of Europe convened an international conference to which specialists in the different fields were invited.

243. "Air Pollution." Tokyo Municipal News, vol. 19, no. 8, November-December 1969, pp. 4-5.

In spite of the Air Pollution Control Law enacted in June 1968, little improvement has resulted from its enforcement in the Tokyo metropolitan area. In accordance with the law, air pollution alerts are issued when the concentration of pollutants is such that it poses a menace to the health of citizens.

244. "Air Pollution Administration under Primary Law of Public Nuisance Control." (Kogai Taisaku Kihonho Ka No Kogaigyosei.) Doboku Gakkaishi (J. Japan Society of Civil Engineers), vol. 55, no. 3, March 15, 1970, pp. 44-48. (Text in Japanese.)

Major administrative efforts to obtain the degree of air pollution control envisaged by the primary law of public nuisance control are reviewed. The ambient emission standards established by the law provide the basic direction for air pollution administration activities, and reasonable criteria for all judgments. In accord with control efforts, emission sources are subject to air monitoring and other programs.

245. "Anti-smog Regulations." (Norme Anti-smog.) Collezione Legale Pirola (no. 1278), Milano, 1969. 110p. (Text in Italian)

A compilation is presented of related documents issued by various branches of the Italian government for both stationary and mobile source air pollution. Measures against air pollution specify the organizational machinery for an anti-pollution campaign and give norms for heating plants, fuels, surveillance of pollution sources, industrial norms, and motor vehicle regulations.

246. Archer, A. "Administrative Procedures and Technical Resources for Air Conservation in the United Kingdom." (Massnahmen der Verwaltung und Technische Mittel zur Reinhaltung der Luft im United Kingdom.) VDI-Berichte (Verein Deutsche Ingenieure, Duesseldorf) no. 149, 1970, pp. 351-358. (Text in German.)

The administrative and technical aspects of air pollution control in Great Britain are reviewed, and the responsibilities of appropriate national agencies are outlined.

247. "Arguments in Favor of the Use of Natural Gas in the Struggle Against Atmospheric Pollution." Gas (The Hague), vol. 89, no. 9, September 1969, pp. 389-393.

Air pollution is not equally acute in all countries. This explains the great difference in the levels of public awareness in various countries. The causes and consequences of air pollution and the main legislative efforts of Belgium, France, the United Kingdom, Italy, the Netherlands, Germany, and the United States are reviewed. The arguments for the use of natural gas as a factor in combating air pollution are given.

248. "Basis for Determining Penalties Paid According to the Act No. 35/1967 SB." (Zaklad Pro Stanoveni Pokut Podle Zakona C. 35/1967 SB.) Ochrana Ovzduši, no. 3, 1969, p. 45. (Text in Czech.)

The Czechoslovakian Act No. 35/1967 SB. is an attempt to include complicated technical, economical, and legal aspects of protection of the atmosphere against pollution into a rather brief legal form. Because of the wide application of the act and the possibility of its ambiguous interpretation, cases which are to be handled according to this act are considered.

249. Bouquiaux, J. et al. "Report of a Belgian Information Mission Relative to the Prevention of Atmospheric Pollution in France." Annales des Mines de Belgique, no. 5, May 1969, pp. 517-562. (Text in French and Flemish.)

Coordination of air pollution research activities in France is officially directed by the Ministry of Social Affairs which has an Interministerial Consultative Commission for this purpose. Apart from this official action, technical working associations and committees have been established. These have created a coordinating committee to unite all research efforts and to advise the government on enforcement measures.

250. Brazell, J. H. "Meteorology and the Clean Air Act." Nature (London), vol. 226(5247), May 23, 1970, pp. 694-696.

Following the London fog of December 1952, the campaign for smoke abatement was intensified and the Committee on Air Pollution was set up. The Clean Air Act was passed in 1956 and gave local authorities powers to establish smoke control regions. As indicated by studies of fog frequency at airports in London, Manchester, Yorkshire, and Glasgow, there has been a steady improvement in visibility within the last decade at both urban and rural sites.

251. Chmel', V. L. and O. V. Kudinov. "Conservation of Air and Water Basins in the General Plans of Cities." (Okhrana Vozdushnogo I Vodnogo Basseyinov V General 'Nykhn Planakh Gorodov) in: Government Committee on Civil Building and Architecture (ed.) Ozodorovleniye Vozdushnogo I Vodnogo Basseyinov Gorodov. (Lecture Series no. 2), Kiev, Budivel'nik, 1968, pp. 23-26. (Text in Russian.)

The need for formal air quality control standards in city planning is pointed out. A hypothetical problem involving two industrial emission sources is discussed in general terms. Amendments to specifications SN 345-66 in particular are called for.

252. "The Clean Air Act, 1968." Smokeless Air (London), vol. 39, no. 148, Winter 1968, pp. 127-130.

The Clean Air Bill received the Royal assent on October 25, 1968. The new act supplements, extends, and in part repeals the provisions of the 1956 act. Clauses 2, 6, and 8 to 15 will become effective on April 1, 1969; the remaining clauses will become effective later as dates yet to be announced. Some of the provisions of the new act are discussed briefly.

253. Cleary, Graham J. "A Status Report: Air Pollution Control in Australia." J. Air Pollution Control Association, vol. 19, no. 7, July 1969, pp. 490-496.

All but one of the Australian states now have legislation to control air pollution. These are similar in broad principle and rely upon the system of prior approval and the use of emission limits. A major outstanding problem is the lack of air pollution considerations in land-use planning at regional and local government levels.

254. Cyrankiewicz, J. "Decree of the Council of Ministers of 26 September 1967 Concerning Principles Used to Determine the Amount of Fines Imposed on Establishments for Exceeding the Amount of Dust which Can be Discharged in the Air." Laws and Decrees on Air Pollution in Poland: Dziennik Ustaw (Warsaw), no. 40, October 21, 1967, pp. 323-324. (Translated from Polish. Joint Publications Research Service, Washington, D. C., R-9122-D, pp. 7-8, February 23, 1968.)

A regulation is presented which outlines the computation of fines against establishments exceeding the permissible amount of dust emitted into the atmosphere in Poland.

255. "Czechoslovakian Law of April 7, 1967, on Air Pollution Control." (Legge Cecoslovacca del 7 Aprile 1967 Sulla Lotta Contro l'Inquinamento Atmosferico.) Ingegneria Sanitaria, vol. 16, no. 6, November-December 1968, pp. 460-463. (Text in Italian.)

In a series of 19 articles, the Czechoslovakian law defines air pollution; imposes a series of taxes and fines on offending industries and the procedures for collection of such monies; and designates the Ministry of Forests and Waters as the agency responsible for air pollution programs, methods of measurement, and scientific and technical research on the subject.

256. Detrie, J. P. "Establishment of Tolerable Limits for Emission and In the Environment." (L'Establissement des Limites Tolerables a l'Emission et Dans l'Environnement.) Pollution Atmospherique (Paris), vol. 11 (special issue), February 1969, pp. 53-61. (Text in French.)

A review of the establishment of emission limits from the point of view of the Council of Europe is presented. The author points out the difficulty of uniform standards of pollution measurement and reviews present legislation for the United Kingdom, the Federal German Republic, Belgium, Denmark, Italy, Switzerland, the Netherlands, and Czechoslovakia, with a more detailed study of regulations for France and Paris.

257. Dreyhaupt, F. J. "Means and Aims of Emission Inspection." (Mittel und Ziele Behordlicher Emissionsueberwachung), VDI-Berichte (Verein Deutsche Ingenieure, Duesseldorf), no. 149, 1970, pp. 33-40. (Text in German.)

Source inspection is necessary to protect neighboring residential areas against the hazards of air pollution, while monitoring of emissions aids in determining casual connections in cases of harmful effects. It provides the basis for setting up emission standards. Emission monitoring inside the plant is a regular task, best done by continuous techniques, although the recording units are expensive which limits their use to large industrial complexes.

258. Felix, R. "The Regulation of Atmospheric Pollution." (Reglementation de la Pollution Atmospherique.) Revue d'Hygiene et de Medecine Sociale (Paris), vol. 16, no. 2, 1968, pp. 175-194. (Text in French.)

Air pollution, caused by domestic furnaces, automobile traffic, and industrial installations, has grown rapidly in various countries. Since public health is jeopardized, a number of countries are attempting to suppress or reduce pollution by imposing limits on the amount of noxious substances contained in emissions. Federal or regional air pollution regulations now in effect throughout the world are summarized and several technologies for achieving air pollution control are discussed.

259. Field, A. A. "Tall Chimneys. Europe's Answer to the Sulfur Dioxide Problem." Heating, Piping, Air Conditioning, vol. 42, no. 4, April 1970, pp. 125-126, 128.

The dramatic reduction in ground level concentration of SO₂ that result from the use of tall chimneys instead of many low ones has been reported on. The United Nations Economic Commission for Europe has found the tall chimney to be a valuable tool in the reduction of the SO₂ component of smog.

260. Fletcher, R. H. "Kitimat Pollution Control By-Law." Pulp and Paper Magazine of Canada (Quebec), vol. 71, no. 7, April 1970, pp. 78-90.

Land use in the 16-year-old town of Kitimat, B. C., was planned to minimize the conflicts that can exist between residential areas and industry. To preserve the quality of its environment, the town passed a waste emission by-law that requires the monitoring of selected emissions from its pulp mill and smelter. The law, to become effective in December 1970, identifies a tolerable level of pollution which is expected to be met, but not exceeded, by the two industries.

261. Garner, J. F. and R. K. Crow. Clean Air - Law Practice, 3d ed. London, Shaw, 1969. 506p.

In this book, the whole of the practice, technical and legal, is described in detail. A heavily annotated print of the 1956 and 1968 acts, and a print of all the regulations, the Ministry Memoranda and most of the circulars on the subject is given. Throughout the book references are given to British standard specifications and Codes of Practice, technical publications and forms for use in practice.

262. Gazivoda, Vladimir and Leonard Putz. "Air Pollution in Yugoslavia and Legal Regulations for the Clean-up of the Environment." (Aerogagadenja u Sfrj I Zakonski Propisi Koji se Odnose na Sanitaciju Okoline.) Kemijska Industrija (Zagreb), vol. 5, 1969, pp. 323-326. (Text in Serbo-Croatian.)

The influence of air pollution on human health, particularly on the respiratory system, is discussed. Data on the situation in cities throughout the world and in Yugoslavia are also given. Laws and regulations designed to secure more favorable hygienic and sanitary conditions are cited.

263. Germany. Ministry of Labor and Social Welfare, North Rhine-Westphalia. Keeping the Air Pure in North Rhine-Westphalia (Reinhaltung der Luft in Nordrhein Westfalen.) Congress der Reinhaltung der Luft, Duesseldorf, West Germany, 1969, October 13-17. (Translated from German: Belov and Associates, Denver, Colo., 133p., February 11, 1970.)

The centers of industrial concentration in North Rhine-Westphalia are also those of population concentration. The close juxtaposition of these concentrations of emittants of air pollutant material and the densely situated population causes extreme problems. The directed measures of the last ten years against the unbearable dust load and the harmful sulfur dioxide emissions have led to considerable improvements.

264. Gilpin, Alan. Control of Air Pollution. London, Butterworths, 1963. 514p.

A textbook dealing with the practical implementation of the Clean Air Act (1956) and allied legislation in Great Britain.

265. Gonschorek, Dietmar and Gerhard F. Mueller. "Feasibilities and Limits of Financial Penalties for Air Polluters." (Moeglichkeiten und Grenzen Oekonomi Scher Regelungen zur Reinhaltung der Luft.) Chemische Technik (Leipzig), vol. 22, no. 3, March 1970, pp. 158-161. (Text in German.)

In an industrial center, the effect of financial penalties for air polluters was studied. After two years, it was shown that not all excessive emissions could be limited this way. Power plants frequently were unable to cope with their emissions within reasonable expenditures. Completely new plants are required in order to reduce the emissions to the required limit. For the chemical industry, the penalties were too low to be an effective incentive. But between these two extreme cases, there were those which found it less expensive to install control facilities than pay the penalties.

266. Grotterod, K. "Air and Water Pollution in Sweden: The Problem, the Efforts and the Progress." Pulp and Paper Magazine of Canada (Quebec), vol. 7, no. 5, March 6, 1970, pp. 64-66.

Like most other developed countries, Sweden has found that its lakes and rivers are being choked by municipal sewage and industrial wastes, and its air is being contaminated by pollutants. Swedish legislation covers discharge of effluent, solids or gas from land, building or installation into water courses, lakes, or other waters; use of land, building or installation in a manner which can cause pollution of water courses, lakes, or other waters; and use of land, building or installation in a manner which can cause disturbance to the surroundings by air pollution, noise vibration or other such environmental hazards.

267. Hart, S. J. "Problems of Gaseous Effluents." Paper presented at a meeting of the Combustion Engineering Association, Manchester, March 25, 1969. 20p.

A brief history of clean air and emissions control legislation in England is given, starting with the Alkali Works Regulation Act of 1863, which limited concentrations of hydrochloric acid in the exit gases of alkali processing, and culminating in the Clean Air Act of 1968.

268. Hashimoto, Michio. Air Pollution and Air Management: Present Status in Japan. Tokyo (Japan), Ministry of Health and Welfare, Environmental Pollution Control Section, 1968(?). 8p.

Government response to the ever increasing air pollution problem in Japan is reviewed. Requirements for air management research are outlined with specific attention given to measurement, analysis of processes relating emissions to observed ambient pollution levels, effects of exposure to specific pollutants, and research related to emission control systems.

269. "Health Effects of Air Pollution." WHO Chronicle, vol. 23, no. 6, June 1969, pp. 264-274.

Review of a symposium on the health effects of air pollution was held in Prague on November 6-10, 1967, for the purpose of reviewing progress in the field in Europe since a previous symposium on the same subject was held in Copenhagen in 1960.

270. Hess, W. "Organization and Operation of the Laboratory for Atmospheric Hygiene of the City of Zurich." Chemische Rundschau, vol. 17, no. 15, 1964, pp. 3-11. (Translated from German: Joint publications Research Service, Washington, D. C., R-2938-D, 19p., January 12, 1968.)

The legal foundations for the establishment of the sanitary inspectorate; instruments that have been developed for the continuous measurement and sampling of pollutants; problems of automotive exhaust emissions; problems of controlling emission from industrial sources; and the role of the municipal atmospheric hygienic commission as a consultant to the sanitary inspectorate are discussed.

271. Hockin, L. E. "Present Legislation and Possible Future Trends in Air Pollution Control." Paper presented at the symposium of the Institution of Mechanical Engineers, London, England, October 17-18, 1968. 7p.

Air pollution legislation in England and Wales is reviewed with special reference to the alkali acts, the first of which was passed in 1868, to control the discharge of hydrochloric acid from the LeBlanc process for manufacturing sodium carbonate. Over the years, the act was extended to include more processes and more noxious or offensive gases.

272. "International Air Pollution Control Guide Compiled." Clean Air and Water News, vol. 2, no. 50, December 10, 1970, pp. 14-15.

Working copies of the guide compiled by Homer J. Hall et al. for the U. S. Environmental Protection Agency will be available at the end of 1970 under the title "Profile Study of Air Pollution Control Activities in Foreign Countries - First Year Report." It will list activities of 1,200 organizations in 13 foreign countries presenting for each country a profile of activities by organizations of all types of current air pollution control.

273. "The International Union of Air Pollution Prevention Associations." Clean Air Year Book 1968-69, London, National Society for Clean Air, pp. 40-42.

The International Union, that has now been established, consists of nongovernmental organizations only. Its primary functions are to provide collaboration and the exchange of information on air pollution problems and to organize, through its member associations, international congresses.

274. Ireland, F. E. and D. H. A. Price. "Incineration: Statutory Requirements and Environmental Aspects." J. Institute of Fuel (London), vol. 43, April 1970, pp. 115-119.

Statutes concerned with airborne effluents and liquid wastes from incinerators are stated, and some brief notes are given on the more important requirements and their fields of application.

275. "Items of Air Pollution Control Planned for 1969." (Showa 44 Nendo Ni Oite Kojiyo to Suru Kogaiboshi Ni Kansuru Shisaku.) Kogai To Taisaku (J. Pollution Control), vol. 5, no. 9, September 1969, pp. 715-726. (Text in Japanese.)

Each item in the pollution control law is briefly discussed. Chapter 1 consists of plans for a fundamental policy concerning pollution control and contains a definition of environmental standards.

276. Japan. Prime Minister's Office. 1969 White Paper About Public Nuisances. (Kogai Hakusho.) Tokyo, Printing Bureau of the Ministry of Finance, 1969, 230p. (Text in Japanese.)

This report (prepared in collaboration with 11 ministries and agencies, government of Japan, for submission to the Japanese Diet), summarizes the status, monitoring techniques, and management, including laws, of air and water pollution, noise and vibration, and soil erosion in Japan as of April 1969.

277. Kaino, Michitaka. "Environmental Pollution and Tokyo." Tokyo Municipal News, vol. 19, no. 8, November-December 1969, pp. 2-3.

The air pollution problem in Tokyo began from the time when oil replaced coal as a major fuel. It is estimated that 15 percent of the national total of measured pollution substances is concentrated in the Tokyo area (700 kilometers). Measures to control air pollution have been enacted first at the local, then at the national level, with the enactment of the Tokyo metropolitan government Soot and Smoke Control Ordinance of 1963 and the national government Air Pollution Control Law of 1968.

278. Kennan, George F. "To Prevent a World Wasteland; a Proposal." Foreign Affairs, vol. 48, no. 3, April 1970, pp. 401-413.

After a discussion of present international efforts and organizations dealing with environmental problems and the difficulties involved, a proposal is made for the creation of an international environmental agency, initiated and supported by the leading industrial nations of the world.

279. Kennet, Lord. "Clean Air--Where Now?" Smokeless Air (London), vol. 38, no. 146, Summer 1968, pp. 228-233.

Great progress has been made in achieving clean air in Britain during the past 10 years. Future policy for clean air must aim at further reducing domestic smoke, grit and dust emissions from industrial furnaces, gaseous pollutant, and motor vehicle exhausts.

280. Koda, Masataka. "Progress of Public Nuisance Law, Part I--Registrative Purpose and Explanation of Air Pollution Control Law." (Kogai Ho No Shinten ((Sono I))--Taiki Osen Boshi Ho No Rippo Shushi To Kaisetsu.) Kogai To Taisaku (J. Pollution Control), vol. 4, no. 9, September 15, 1968, pp. 591-598. (Text in Japanese.)

Progress made under the public nuisance law and the difference between the original and revised form of the law are discussed. The general purpose of the 1952 stack smoke law was to restrict stack emissions, but restriction was only partially successful. Aspects of the new law are also discussed.

281. Koizumi, Takao. "To Promote the Development of Policy for Public Nuisance." (Sangyo Kogai Taisaku No Genjyo To Sono Sesaku--Taisaku No Shinten O Kishite) Kogai To Taisaku (J. Pollution Control), vol. 5, no. 11, January 15, 1969, pp. 27-30. (Text in Japanese.)

Some ideas are presented for making air pollution control policies more effective in Japan. Particular attention is paid to the problem of stationary source pollution from industrial plants. The Ministry of Industry and International Trade has issued an act requiring a general survey of industrial pollution to be made in advance of industrial construction. It helps to prevent air and water pollution in advance. More potential pollution areas or districts are to be included in appointed surveys.

282. Latsky, C. E. "Report from South Africa." Smokeless Air (London), vol. 38, Summer 1968, pp. 250-251.

This article reports on the implementation of the Atmospheric Pollution Prevention Act in South Africa and on the national air pollution conference at Cape Town in October 1967.

283. "Law of Air Pollution Control." (Taiki Osen Boshi Ho.) Kogai To Taisaku (J. Pollution Control), vol. 4, no. 7, July 15, 1968, pp. 459-464. (Text in Japanese.)

The text of the law of air pollution control is presented and additional decisions of the House of Representatives Special Committee for Industrial Pollution Control are discussed.

284. Legner, M. "About the Activity of the State Technical Inspection of Air Conservation." (Connost Statni Gechnicke Inspekce Ochrany Ovzduši.) Ochrana Ovzduši, no. 2, 1969, pp. 17-19. (Text in Czech.)

Measures against air pollution, according to Act No. 35/1967, are characterized by the imposition of penalties in cases of air pollution, by increased administration power of regional air control authorities, and by increased responsibility of the Ministry of Forestry and Water Resources in the field of air conservation.

285. Loos, Jaroslav. "Emissions From Factory Chimneys." (Kominove Exhalace Prumyslovych Zavodu.) Prumysl Potravín, vol. 20, no. 3, 1969, pp. 87-88. (Text in Czech.)

Czechoslovakian public laws fixed the maximum safe hourly concentrations of dust and sulfur ash. To comply with the law, designers of new factories should provide an estimate of emission of the gases and maximal and average amounts of ash per hour, day, and year; emission of smoke; the height of the chimney; discharge velocity of the gases; caloric content of the smoke; height of the bottom of the chimney above sea level; elevation diagram of the surrounding territory; map of the ground with contour lines; representation on the map of the places that should be protected; and a diagram showing prevailing wind directions for a year. In addition to complying with the law, a new factory design should take into account the present condition of the site and the relative degree of industrialization in which it is to be built.

286. Lund, Herbert F. "An Evaluation of European Industrial Air Pollution Control Practice." Paper presented at the 61st annual meeting of the Air Pollution Control Association, St. Paul, Minnesota, June 23-27, 1968. 10p.

The observations and impressions gained from an air and water pollution study tour of western Europe in October 1967 are summarized. On balance, air pollution control practices were judged to be about on a par with those in the United States, with individual plants ranging from excellent to poor. The tour group visited 17 installations in Holland, Denmark, Sweden, Switzerland, West Germany, and England, and also inspected two pollution control research facilities. In general, the countries visited seemed to rely on a combination of various types of public regulations combined with a persuasive approach to bring about industrial pollution control, as opposed to American practice where heavy public pressure prevails.

287. Matsuda, Toshio. "Present Status of Air Pollution Controls Related to the Combustion of Heavy Oil." (Juyu No Nensho Ni Kankeishita Taikiosen Boshiho No Genkyo.) Netsu Kanri (Heat Management: Energy and Pollution Control), vol. 21, no. 9, September 1969, pp. 33-38. (Text in Japanese.)

All the regulations proclaimed by laws, departmental ordinances, and announcements related to air pollution controls are explained. The air pollution control law forms a part of the fundamental law. It stipulates that any facilities or plants which produce stack smoke must follow the regulations. The law also prescribes the permissible limits of sulfur oxides, soot, dust, and automobile emission.

288. Merk, K. W. "Financial Assistance Provided by the German Government for Air Pollution Control." Wasser Luft Betrieb, no. 11, 1966, pp. 767-768. (Text in German.)

The Federal Republic of Germany is underwriting and crediting programs to facilitate the construction of air pollution control installations. Loans and demonstration activities, tax credits and other measures are discussed in terms of the current air pollution laws and of the funds available.

289. "More Laws are Coming to Halt Pollution." Canadian Chemical Processing, vol. 50, no. 10, October 1968, pp. 60-64.

Processors face tougher standards as public bodies line up new regulations to prevent air and water pollution. Constitutional authority in Canada is lacking for an all-out federal attack, but guidelines for a national clean air act have been drawn up and other legislation is under consideration. Currently, eight provinces either have pollution control acts or are in advanced stages of legislative planning.

290. Ochab, E. and J. Horodecki. "Law of 21 April 1966 on Protection Against Air Pollution." Laws and Decrees on Air Pollution in Poland: Dziennik Ustaw (Warsaw), no. 14, April 29, 1966, pp. 113-115. (Translated from Polish. Joint Publications Research Service, Washington, D. C., R-9122-D, p. 1-5, February 23, 1968.)

The law's nineteen articles which are aimed at maintaining the concentration of pollutants below the maximum allowable concentration are outlined. Enforcement procedures and the duties of establishments emitting pollutants and organizations of the governments handling matters of air pollution are emphasized.

291. Oels, H. "European Cooperation in the Area of Air Pollution Control." (Die Europaeische Zusammenarbeit Auf Dem Gebiet Der Luftreinhaltung) VDI-Berichte (Verein Deutsche Ingenieure, Duesseldorf), no. 149, 1970, pp. 20-26. (Text in German.)

An 18-member organization of European states, "Europarat," has the task to cope with social, cultural, scientific, legal, economic, and administrative problems occasioned by the present technological revolution. Its set of guidelines, formulated for the international control of air pollution, is reviewed, and the air pollution control responsibilities of other international organizations are discussed.

292. "Official Record of the 61st Diet for the House of Representatives Air Pollution Control Special Council." (Dai 61 Kai Shugiin Sangyokogai Taisaku Tokubetsu Iinkai No Kiroku) Kogai To Taisaku (J. Pollution Control), vol. 5, no. 6, June 1969, pp. 67-70. (Text in Japanese.)

A discussion in the Diet about the nature of the House of Representatives Industrial Air Pollution Control Special Council is presented. The point in question was whether the council should belong to Article 3 or to Article 8 of the Administrative Organization Law. The difference between Article 3 and Article 8 lies in the independent authority of the former. It now seems to be the wish of the public that the Industrial Air Pollution Control Special Council be placed under Article 3.

293. "On the Regulation of Environmental Pollution in England." (Eikoku No Toshi Kogai Kisei Ni Tsuite) Netsu Kanri (Heat Engineering, Tokyo), vol. 21, no. 3, March 1969, pp. 29-33. (Text in Japanese.)

Great Britain has attempted to control water and air pollution by administrative action and legislation since 1388 when the Lighting and Watching Act was passed. Laws to prevent air pollution included the Alkali Works Regulation Act (1863) and the Clean Air Act (1956). The Clean Air Council appointed by the Clean Air Act provides advisory services on air pollution when requested. Main studies on air pollution are being conducted at the Ministry of Technology laboratories, but air pollutants are being measured on a nationwide basis.

294. Padovani, C. "How Extreme Are the Rules and the Defenses Against Air Pollution?" Termotecnica (Milan), vol. 23, no. 5, 1969, pp. 264-268. (Text in Italian.)

The new Italian Law No. 615 provides for three types of air pollution abatement: the elimination or reduction of polluting substances, the separation of polluting substances from smoke and gases before they are vented into the surrounding air, and the reduction of their harmfulness. The author contends that, in addition to the measures already provided by Law 615, other actions must be undertaken in Italy to improve air quality such as: population control, promotion of the use of electric heating systems, further research pertaining to better-grade fuels, and the training of special technicians for controlling air pollution.

295. "Province by Province - Here's Canada's Jungle of Pollution Control." Modern Power and Engineering (Toronto, Canada), vol. 63, no. 6, June 1969, pp. 68-69.

A table showing provincial legislation on water and air pollution is presented. Each province operates under its own chosen air pollution legislation including the Public Health Act, the Clean Environment Act, the Health Act, and the Air Pollution Control Act, but few provinces have the knowledge or personnel to carry out a successful campaign against pollution.

296. "Provisions Against Air Pollution Law of July 13, 1966, No. 615." Securitas, vol. 52, November 1967, pp. 151-160. (Text in Italian.)

Complete text is provided of the newly passed Italian law against air pollution. It divides the country into two zones determined by population and industry and stipulates the creation of special committees against air pollution in every region where at least one community is affected by it. The central authority in this field is a commission in the Ministry of Health composed of representatives of all government agencies and scientific institutions dealing with air pollution.

297. "Public Nuisance Control Ordinance in Osaka Prefecture." Osakafu Kogaiboshijorei Ni Tsuite) Kogai To Taisaku (J. Pollution Control), vol. 5, no. 12, December 15, 1969, pp. 1009-1018, 1035. (Text in Japanese.)

The Public Nuisance Control Ordinance in Osaka Prefecture, issued in 1965, was revised and a new one enacted in 1969. The revision was prompted by various legislation, beginning with administrative enforcement on the national policy level with the primary Public Nuisance Control Law, Air Pollution Control Law, and Anti-noise Law. The contents of the new ordinance are explained, chapter by chapter.

298. "Public Nuisance Control Program." (Kogai Boshi Keikaku No Sakutei Ni Tsuite) Taiki Osen Nyusu (Air Pollution News), no. 53, July 1969, pp. 2-12. (Text in Japanese.)

A public nuisance control program for three regions in Japan was presented. Details of the control program were explained. Each of the three regions considered is characterized by promising development in petroleum refining, the petro-chemical industry, production of thermal power, and the iron and steel industry.

299. "Public Nuisance Transaction Law." (Kogaifunso Shoriho.) Kankocho Kogaisenmon Shiryo (Public Nuisance Gazette), vol. 4, no. 4, July 1969, pp. 36-43. (Text in Japanese.)

The Public Nuisance Transaction Law attempts to reach a prompt and fair settlement of pollution problems by forming and authorizing the Public Nuisance Inspection Central Committee to deal with them with the assistance of the municipality and district organizations. All the problems created by industrial pollution are settled by a compromise or reconciliation as decreed by this organization.

300. Putz, L. et al. "Air Pollution in the SFR of Yugoslavia and Law Regulations for the Sanitation of Environment." Kemija u Industriji (Zagreb), vol. 5, 1969, pp. 323-326. (Text in Serbo-Croatian.)

The influence of air pollution on human health, particularly on the respiratory system is discussed. Data on the situation in cities throughout the world and in Yugoslavia are also given. Laws and regulations designed to secure more favorable hygienic and sanitary conditions are cited.

301. "Record of the 61st Senate Special Committee Meeting on Industrial Pollution Control; Financing Public Nuisance Measures and the Responsibility of Industry." (Dai 61 Kai Kokkai Sangiin Sangyo Kogai Taisaku Tokubetsu Iinkai No Kiroku. Kogai No Kyusaihi To Kigyosekinin No Kankei.) Kogai To Taisaku (J. Pollution Control), vol. 5, no. 9, September 1969, pp. 729-732. (Text in Japanese.)

A discussion of the Transaction Bill of Industrial Pollution Conflict and the Special Treatment Bill of Health Suffered by Industrial Pollution was presented. The main point of discussion concerns how the medical expenses for the injured party should be paid and where the responsibility should be placed.

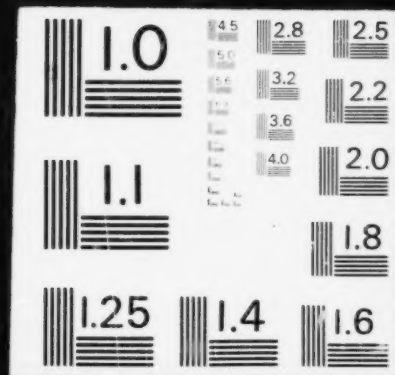
302. Reynolds, F. "A Critical Review of Current Clean Air Legislation." Royal Society of Health (London), vol. 88, no. 6, November-December 1969, pp. 276-280.

Air pollution control legislation should be enacted with the purpose of preventing or minimizing at each source the emission of air pollutants. When total prevention of emission is impracticable, pollutants should be discharged at high level for dispersion. The implications of the Clean Air Act of 1968 are examined.

303. Sangyosho, Tsusho. "Regulations for Air Pollution Control." (Taiki Osen Boshi No Tameno Ho Kisei.) Kogai To Taisaku (J. Pollution Control), vol. 4, no. 4, July 1969, pp. 172-178. (Text in Japanese.)

The regulational system which forms the constitutional framework in Japanese law for air pollution control is explained.

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304. Sato, R. "On the Prevention of Air Pollution." Kuki Seijo (Clean Air, Tokyo), vol. 6, no. 5, November 1968, pp. 1-5.

Article 147 of the Air Pollution Law of 1959 established administrative agencies for controlling air pollution in Japan. There are now 20 regional air pollution centers, mainly in industrial areas, with the responsibility for limiting the amount of smoke emitted by factories and setting standards for automotive emission.

305. Shiozawa, Kiyoshige. "Worldwide Status of Air Pollution Control and Japan's Standpoint." (Sekai No Taiki Osen Boshi No Genkyo To Wagakuni No Tachiba.) Karyoku Hatsuden (Thermoelectric Power Generation), vol. 20, no. 9, 1969, pp. 789-795. (Text in Japanese.)

Some aspects of air pollution controls currently practiced in foreign countries appear informative and applicable in a technical and administrative sense to Japan. However, the present status of air pollution in metropolitan and large industrial cities in Japan is viewed as more serious than in foreign cities.

306. Shoji, Hikaru. "Capitalism and Public Nuisance." (Shihonshugi to Kogai.) Horitsu Jiho (Law Review), vol. 41, no. 11, September 1969, pp. 4-12. (Text in Japanese.)

The relationship between capitalism and air pollution, which is construed to be analogous with industrial pollution, is analyzed. The concept of air pollution varies according to individual interests or viewpoints. The article questions the ability of the law of air pollution control to define a public nuisance, the legal concept of which is confined to description and illustration of general pollution phenomena.

307. Sparrow, C. J. et al. "The Growth and Work of the Auckland Air Pollution Research Committee." Clean Air, vol. 3, no. 1, March 1969, pp. 3-12.

The work of the committee is described and a summary of the results which have been obtained from its air sampling network is presented.

308. "Special Report on Pollution: More Laws Are Coming to Halt Pollution." Canadian Chemical Processing, vol. 52, October 1968, pp. 60-64.

Feature article dealing with both water and air pollution. The air pollution problem in Canada is reviewed, and the current legislative situation is outlined.

309. "Special Treatment Law for the Injured from Public Nuisance with References Appended." (Kogai Ni Kakaru Kenkohigai No Kyusai Ni Kansuru Tokubetsu Sochiho Oyobi Sankoshiryo.) Kankocho Kogaisenmon Shiryo (Public Nuisance Gazette), vol. 4, no. 4, July 1969, pp. 23-35. (Text in Japanese.)

The Special Treatment Law provides medical aid to those people suffering from diseases due to air or water pollution. The legal procedure includes applying for the medical grant. When an application is made, the governor concerned decides if the disease is caused by air or water pollution, based on advice given by the Authorization Committee of Public Nuisance.

310. Squires, Arthur M., "Clean Power from Coal." Science, vol. 169, no. 3948, August 1970, pp. 821-827.

A technical article indicating efforts of suppressing sulfur dioxide from coal while lowering power costs. Of particular interest is a brief discussion of the "technological response" to the British Alkali Act of 1863 and the possible parallels to present-day air pollution control problems.

311. Sutton, P. "Air Pollution in Petroleum Refining." Chemical and Process Engineering (London), vol. 49, no. 1, January 1968, pp. 36-38.

The statute law relating to air pollution is wide in coverage but not too onerous in its requirements. The author discusses common law as it affects the pollution of air, and considers in detail the two statutes applicable in petroleum refining-- the Alkali and the Clean Air Acts.

312. "The Tokyo Metropolitan Environmental Pollution Control Ordinance." Tokyo Municipal News, vol. 10, no. 8, November-December 1969, pp. 13-20.

The full text of Ordinance No. 97 of July 2, 1969, is given. The ordinance tries to define environmental pollution as air, water, noise, vibration and offensive smells. It defines the obligations of the governor and means of control, provides for arbitration over disputed cases and lists penal provisions.

313. Tucker, L. E. "The Practical Application of Air Pollution Control Measures." Royal Society of Health J. (London), vol. 88, no. 1, January-February 1968, pp. 33-34, 37.

Air pollution control in South Africa is discussed, with particular reference to the Atmospheric Pollution Prevention Act of 1965. This act deals with the control of noxious or offensive gases and dust control, as well as pollution by smoke.

314. United Nations. Economic and Social Council. Questions Relating to Science and Technology, Environmental Pollution and Its Control; report by the World Health Organization. 28 February 1968. 11p. (E/4457)

315. _____. Addendum No. 1. 29 February 1968. (117 p.) (E/4457/Add.1)

A general survey of air pollution in part one of this report summarizes the main international and national research on pollution by a number of WHO scientific groups and presents their conclusions and recommendations. Contains supplementary information from WHO on air pollution.

316. Vancura, J. "Protection of the Atmosphere in Czechoslovakia." Ochrana Ovzduši, vol. 50, January 1969. (Translated from Czech. Belov and Associates, Denver, Colorado, 17p., April 20, 1970.)

Objectives of new Czech air pollution legislation are to provide future and existing industries with the technology for controlling pollutants, to initiate a program of plant inspection and of fees and fines for air pollution; and to consider alternatives to the existing fuel and power base.

317. Wiethaup, H. "The (Federal German) Law Relating to Preventive Measures for Keeping the Air Clean, of May 17, 1965." Staub, vol. 28, December 1968, pp. 522-525.

The object of the Clean Air Law (BGBI. I S.413, Federal Law Paper I, p. 413) is to abate the increasing air pollution. Related legislation passed by local regions in Federal Germany is discussed.

318. Yoshimura, T. "Japan Toughens SO₂ Controls." Chemical Engineering, vol. 76, no. 25, November 1969, pp. 144, 146.

With 100 million people crowded into an area the size of California, and with industry growing more rapidly than in any other nation, Japan has set an extremely stiff standard for SO₂ emission in highly populated areas.

10. CRITERIA DEVELOPMENT AND EVALUATION

10.1 General Reading

319. ABT Associates, Inc. "Incentives to Industry for Water Pollution Control: Policy Considerations." A Report to the Federal Water Pollution Control Administration, Washington, D.C., 1967. 119 p.

A study of cost sharing measures (including accelerated depreciation, tax credits and low interest loans) for the control of water pollution by the private sector.

320. Advances in Environmental Sciences and Technology. Vol. I. Edited by J. N. Pitts, Jr. and R. L. Metcalf. New York, Wiley, 1969. 356 p.

The aim of the volumes in this series is to help delineate and solve the multitude of environmental problems our technology has created. Nine previously unpublished chapters range from an extensive introductory overview of environmental science by the editors to such diverse articles as "The Federal Role in Pollution Control" by Congressman John Tunney and "Aeroallergens and Public Health" by Professor William R. Solomon.

321. Ayres, Robert U. and Susan C. Simon. "Policy Alternatives for Environmental Management." Paper presented at George Washington University, Washington, D.C., March 23, 1971. 59 p.

Postulating that government policies frequently fail to achieve their aim because they are drawn up within too narrow a framework, the authors analyze and compare 28 possible policies relating to 15 separate environmental goals. A major conclusion is that the charges approach for air pollution control compares favorably with other pollution control measures reviewed.

322. Barth, D. S. "Public Health Aspects of Air Pollution." Paper presented at the Symposium and Panel on Chronic Pulmonary Insufficiency and Problems of Air Pollution, New York, July 16, 1969. 7 p.

Following a discussion of the federal role in implementing the Air Quality Act, this article reviews the major problems of research to identify the effects of pollutants on health. The problems are (1) to determine long-term effects of air pollutants; (2) to identify individuals most sensitive to pollutants; (3) to develop a health surveillance network; (4) to define a health hazard index; (5) to identify additional environmental factors that interact with pollutants; and (6) to identify indicators in humans of effects which occur before long-term deleterious effects become apparent.

323. Baruch, Stephen B., Frank L. Cross, Jr., and Roger W. Ross. "The Systems Approach in Industrial Air Pollution Control Decisions." Paper presented at the Air Pollution Control Association Annual Meeting, New York, June 22-26, 1969. 12 p.

Air pollution control legislation in the United States is discussed; industry's increasing awareness of the need to control environmental pollution is reviewed in the light of the Air Quality Act of 1967. Systems analysis is suggested as a method by which industrial management can arrive at decisions concerning pollution abatement.

324. Berry, R. Stephen. "The Chemistry and Cost of Contamination. Perspectives on Polluted Air —1970." Bulletin of Atomic Scientists, vol. 26, no. 4, April 1970, pp. 2, 34-41.

The problems of pollution abatement are partly technological, partly economic and partly political. One of the chief suggestions to achieve the national goal of improved air, is the creation of strong, well-funded and highly directed task forces, akin to NASA, to solve specific technological problems of environmental management.

325. Bylinsky, Gene. "The Long, Littered Path to Clean Air and Water." Fortune, vol. 82, Oct. 1970, pp. 112-115.

Effective control of air and water pollution is a slower and costlier job than envisaged by many politicians and environmentalists. Enforcement of stiff new legislation on all levels will speed up the job but advances in technology and willingness of business, government and the public to encourage, apply, and pay for technological improvements is necessary.

326. Dales, J. H. Pollution, Property and Prices. An Essay in Policy Making and Economics. Toronto, Ont., Univ. of Toronto Press, 1968. 111 p.

The author describes the nature of the pollution problem and the growth of interest in environmental quality and gives a detailed account of the passage and contents of each major air and water pollution act passed to date by Congress. A second section deals with the forces which shape pollution policy — Congress, the Executive Branch, public opinion, interest groups, and state and local government. Finally, the policy process for controlling pollution and research, standard-setting, and compliance problems are examined. Practical suggestions are also offered for improving pollution control policies.

327. Davies, J. Clarence, III. The Politics of Pollution. New York, Pegasus, 1970. 232 p.

Examination of major policy process in controlling pollution: research and standard-setting, compliance and goals. Examples of inadequacies and possible remedies are discussed. This book is one of the most comprehensive works presently available on the subject.

328. The Domestic Council, Executive Office of the President. The President's 1971 Environmental Program. Controlling Pollution (Book one of a three-part series). Washington, D.C., U. S. Govt. Print. Off., 1971. 11 p.

The proposals discussed in this booklet are aimed at strengthening pollution control programs. They include an incentive charge on sulfur oxide emissions, a tax on lead in gasoline, a nation-wide waste treatment financing program, tightened water pollution standards and enforcement and changes in the pesticides law.

329. The Environment; A National Mission for the Seventies. By the editors of Fortune (magazine) New York, Harper, 1970. 220 p.

The chapters of this book originally appeared in the October 1969 and February 1970 issues of Fortune magazine. Partial contents: Industry starts the big cleanup (John Davenport); The economics of environmental quality (Sanford Rose); Cars and cities on a collision course (A.T. Demaree); Some burning questions about pollution (Tom Alexander).

330. Environmental Studies: Papers on the Politics and Public Administration of Man-Environment Relationships, Lynton K. Caldwell (ed.) Bloomington, Indiana University, Institute of Public Administration, 1967. 4 v.

Essays on political dynamics of environmental control (vol. 1); intergovernmental action on environmental policy (vol. 2); politics, professionalism and the environment (vol. 3); research on policy and administration in environmental quality programs (vol. 4). This publication resulted from a seminar on the political dynamics of environmental change, sponsored by the Conservation Foundation (1965). The purpose of the seminar was to identify and in some measure define the principal political problems and pressure points encountered in any public effort to control the course of environmental change.

331. Esposito, John C. Vanishing Air. New York, Grossman Publishers, 1970. 328 p.

A study by a group of law, science, engineering and medical graduate students of the operations of the National Air Pollution Control Administration against a backdrop of political and economic institutions in 1969.

332. Gerhardt, Paul H. "How Much Is Air Pollution Costing?" Ohio's Health, vol. 22, nos. 11 and 12, November-December, 1970, pp. 5-13.

An approach to the assessment of damages caused by air pollution using an adaptable, four-step procedure that can be applied on a regional basis. The discussion is based on statistics relating to many kinds of damages, including those caused to property, livestock, farm crops, consumer goods and health.

333. Grava, Sigurd. Urban Planning Aspects of Water Pollution Control. New York, Columbia University Press, 1969.

A synthesis of the literature on water pollution as it applies to urban planning including information on sources and types of pollutants as well as sewage collection and treatment methods. There is also a discussion of the financial and administrative aspects of water pollution control. The book concludes with an examination of water quality problems in developing countries.

334. Hagevik, George H. Decision-Making in Air Pollution Control. A Review of Theory and Practice, with Emphasis on Selected Los Angeles and New York City Management Experiences. New York, Praeger Publishers, 1970. 217 p.

Case studies of Los Angeles and New York City enable the author to point out ways of dealing with some of the many problems confronting regional authorities in their attack on air pollution. The discussion covers individual pollutants, and the technical, socio-economic and legal aspects of control including the potential role of effluent fees, payments, and direct regulation. In discussing strategies for air quality management, the role of bargaining is given major emphasis.

335. Hill, Gladwin. "The Politics of Air Pollution: Public Interest and Pressure Groups." Arizona Law Review, vol. 10, 1968, pp. 37-47.

Although air pollution is a nonpartisan problem, it must be handled by government. This involves the reconciliation of many different interests. The article provides a general discussion of the ambivalent attitudes of both government and industry and comments on the influence of citizen pressure groups.

336. Institute of Public Administration. "Governmental Approaches to Automobile Air Pollution Control." Report submitted to the Air Pollution Control Office of the Environmental Protection Agency, Washington, D.C., March 1, 1971. 146 p.

A comprehensive survey of the governmental approaches government can take to control automotive air pollution emissions. An analytic framework is developed to facilitate the comparison of existing policies and the discovery of new policy possibilities. A large body of information (including Congressional Hearings, statements by government and industry leaders, journal articles, and various reports) are reviewed and cited for further reference.

337. _____. "Industrial Incentives for Water Pollution Abatement." A Report to the U.S. Department of Health, Education, and Welfare. Washington, D.C., 1965. 95 p.

A study of measures to encourage and assist private industrial firms in abating water pollution designed to provide background information on which to base discussion and informed judgment. Some of the subjects covered are: The Industrial Pollution Problem; Economic Aspects of Pollution; Federal Incentives; and State and Local Incentives.

338. Jameson, R. M. "Challenging the Air Pollution Problem with Systems Analysis." Paper presented at the symposium of the American Society of Mechanical Engineers, Albuquerque, New Mexico, Nov. 16-17, 1968. 14 p.

A historical description of the federal legislation is shown to provide framework wherein current system analysis activities are proceeding. One of the several systems models currently being developed is described. The model will permit rapid testing of the consequences of various control strategies and should permit regional authorities to more effectively arrive at their air quality standards and control implementation plans.

339. Katz, Milton. "The Role of the Legal System in Society's Implementation of Technology Assessment." Paper presented to seminar at George Washington University, Washington, D.C., May 6, 1971. 23 p.

An analysis of the complex factors involved in implementing technology assessment in relation to protection of the environment and control of pollution. The author believes that while private legal actions can play an important part in implementation, they can at best constitute no more than a complement to other more major approaches.

340. Kneese, Allen V. and Blair T. Bower. Managing Water Quality: Economics, Technology, Institutions. Baltimore, Johns Hopkins, 1968. 328 p.

This comprehensive study on resource management combines fundamental economic theory, scientific and technological principles, empirical data, and approaches to institutional structure. The authors' underlying contention is that if full information were available on all alternative costs of waste control and of all damages associated with deterioration in water quality, the most economically efficient management program for an entire basin would be one in which the marginal costs of treatment equalled the marginal cost of damages prevented. Because of the generality of its conceptual framework, the contribution of the book extends beyond the confines of the specific problem of water quality to many other issues of environmental management.

341. Krieger, Martin H. "Six Propositions on the Poor and Pollution." Policy Science, vol. 1, no. 3, Fall 1970, pp. 311-324.

The article maintains that it is an illusion to believe that environmental quality could be a separable issue from problems related to equity. The effect of improving the environment may be greater inequities. Present programs maintain this inequity; proposed ones may aggravate it. A political coalition of environmental and equity forces is proposed to solve this problem.

342. Larsen, Ralph I. "Relating Air Pollutant Effects to Concentration and Control." J. Air Pollution Control Association, vol. 20, no. 4, April 1970, pp. 214-225.

The article describes a dozen air management steps to proceed from the determination of air quality criteria to an enforcement process leading to clean air.

343. Lieber, Harvey. "Public Administration and Environmental Quality." Public Administration Review, vol. 30, no. 3, May-June 1970, pp. 277-286.

Despite the rising national and international concern over the deterioration of the environment there has been an institutional and political lag. This article is a brief survey or situation paper on the environmental crisis and an analysis of the slow response of public policy and institutions to the challenge.

344. Low-Beer, Anthony B. "The Use of Effluent Charges to Control Air Pollution and Induce an Efficient Allocation of Resources." Unpublished Ph.D. dissertation, Columbia University, New York, 1970. 197 p.

The author describes individual pollutants and their effects in order to discuss the nature of social costs of air pollution. He reviews the literature on external costs and resource allocation, pointing out that emission charges for air pollution are more efficient than a bargaining system. This leads to a discussion of the superiority of emission charges over standards, with a chapter devoted to levying and assessment of emission charges on industrial emitters, automobiles, airplanes, and residential emitters.

345. National Conference on Air Pollution, Washington, D.C. Proceedings. U.S. Public Health Service, 1958, 1962, 1966 -

Conferences held "to provide a forum in which the many segments of American society involved with, and affected by, air pollution could present their ideas and recommendations for more effective control of a growing environmental problem."

346. Peterson, James T. The Climate of Cities: A Survey of Recent Literature. (Publ. no. AP-59), Raleigh, N.C., National Air Pollution Control Administration, 1969. 48 p.

Review of urban-rural comparative studies discussing aspects in which the climate of a city differs from that of the rural areas around it. Effects of air pollution control on visibility are discussed on pp. 22-24.

347. Potter, Frank M. Jr. "Pollution and the Public." The Center Magazine (Center for Study of Democratic Institutions), May 1970, pp. 18-23.

Convinced that the regulatory agencies have failed to protect the public interest in the field of social controls, the author suggests that concerned members of the public be furnished with the necessary information and authority to handle pollution offenses directly. Some of the considerations implicit in implementing such a system are discussed.

348. Sax, Joseph L. "Defending the Environment: A Strategy for Citizen Action." Ecology Law Quarterly, vol. 1, no. 1, Winter 1971, pp. 228-239.

Believing that administrative agencies have failed in their task of protecting the public's environmental interests and supporting his argument with many case studies, the author advocates a more assertive role for the individual in defending his rights through courts and legislatures. He suggests a number of legal techniques whereby existing procedures for solving environmental problems might be reformed. Professor Sax draws on his practical experience, gained during the preparation of Michigan's 1970 Environmental Protection Act.

349. Stern, Arthur C. (ed.). Air Pollution Volume III: Sources of Air Pollution and Their Control. New York, Academic Press, 1969. 866 p.

This is the second edition of a comprehensive analysis of air pollution. Part 9 deals with air pollution control, air pollution control legislation, air pollution standards, air pollution control administration, public information and education, and air pollution literature resources.

350. Stimulating Community Cooperation in Air Conservation. Proceedings of Air Pollution Control Conference, University of California Extension, Santa Barbara, 20 June 1969.

The purpose of this conference, sponsored by the National Air Pollution Control Administration, was to "start an effective effort toward rectifying a growing problem," with the "cooperation of everyone." Among topics discussed at the conference: effects of air pollution; multiple causation of respiratory disease; meteorologic aspects of air pollution; engineering aspects of air pollution, and others.

351. U.S. Advisory Commission on Intergovernmental Relations. State Legislative and Constitutional Action on Urban Problems in 1967. (M-38) Washington, D.C., April 1968. 29 p.

Current information concerning the rapidly changing state-local relations has been assembled. For example in such areas as air pollution, one of the focal points in the traditional debate over the viability of the American federal system is the proper role of the states in relationship to local governments.

352. U. S. Department of Health, Education, and Welfare. Manpower and Training Needs for Air Pollution Control: Report of the Secretary of Health, Education, and Welfare to the Congress of the United States. (91st Cong., 2d sess., S. Doc. no. 91-98) Washington, D.C., U. S. Govt. Print. Off. 44 p.

A survey of the manpower, recruitment and training needs of federal, state and local government agencies and the private sector. Programs through which the Federal Government proposes to help meet these needs are also described.

353. U.S. Public Health Service. National Center for Air Pollution Control. A Proposal for an Air Resource Management Program (Interstate Air Pollution Study Phase II Project Report, vol. VIII), Cincinnati, Ohio, May 1967. 132 p.

Among the recommendations on the organization of the program: establish a means for joint pollution control activity involving state and local agencies, by agreement or compact between the states of Missouri and Illinois; develop a regional organization; establish a functional linkage between regulatory and urban planning activities directed toward preventing air pollution problems arising from land-use and air-use conflicts; plan for governmental air pollution program expenditures at a level of 50 cents per capita per year by 1970.

354. U.S. Task Force on Research Planning in Environmental Science. Man's Health and Environment, Some Research Needs. Washington, U.S. Govt. Print. Off., 1970. 258 p.

A report containing recommendations on environmental research needs. Research recommendations, of a primarily technical nature, are made for the fields of epidemiologic studies, exposure measurement, indices of air pollution effects, experimentation with animals and laboratory studies of human beings.

355. Wohlers, H. C., et al. "Can Air Pollution Be Controlled by Legislation?" Scientiae, vol. 104, nos. 681-2, series VIII, January-February 1969, pp. 58-64.

Effective industrial pollution control will ultimately yield a savings for the consumer. Effective control requires legislation capable of ready enforcement. Adequate legislation must consist of specific standards on emission sources, and not of unenforcible generalities. The general public must provide sufficient operating funds and ensure enforcement.

356. Wood, Adrian J. B., J. Serge Taylor, Frederick R. Anderson, and Laurence I. Moss. "Strategies for Pollution Abatement. Comparisons of Direct Regulation, Economic Incentives, and Control by Litigation." A staff study to the Committee on Public Engineering Policy, National Academy of Engineering, Washington, D.C., January 22, 1971. 240 p.

A study of pollution abatement policies undertaken with the aim of providing a basis for informed decision-making regarding the many alternatives now available. Among their conclusions, the authors note that emission charges can be a powerful policy implement in abatement and believe that this approach deserves greater attention than it has received to date.

357. Zimmer, C. E. "The Air Quality Data Bank" in: Proceedings of the IBM Scientific Computing Symposium on Water and Air Resource Management, held on October 23-25, 1967, at the Thomas J. Watson Research Center, Yorktown Heights, N. Y., pp. 31-49.

The Congress of the United States has specifically charged the Secretary of Health, Education and Welfare with the responsibility for issuing air quality criteria which in his judgment are required to ensure clean air and the development of such criteria depends on knowledge of existing levels of air pollution. Thus, air surveillance activities are currently being carried out by agencies of federal, state and local governments. In order to make the resulting data immediately available the National Center for Air Pollution Control has established the National Air Quality Data Bank.

10.2 Sources of Information

358. APCA Abstracts. Pittsburgh, Pa., Air Pollution Control Association. (Monthly.) 1955-

Published by the Air Pollution Control Association in cooperation with the U.S. Public Health Service and the Library of Congress. It contains approximately 1100 abstracts a year of journal articles, books, government documents, and papers pertaining to various aspects of air pollution in the United States and foreign countries. Cumulated author and subject index from time to time.

359. Air Pollution Abstracts. Stevenage, Great Britain Ministry of Technology, Warren Spring Laboratory. (Monthly)

Over 700 primary and secondary sources are reviewed to abstract articles related to the problems of air pollution around the world. No list of original sources is available. Subject and author indexes are kept at the laboratory and may be published at some time in the future.

360. Air Pollution Publications: A Selected Bibliography 1963-1966. (PHS Publ. no. 979), Washington, D.C., Public Health Service, Division of Air Pollution, 1966, 144 p.

This book continues the listings of an earlier publication. It contains approximately 900 references to publication by Division of Air Pollution personnel and other persons and organizations receiving federal air pollution funds in classed arrangement with author and title indexes. In addition to published papers it also includes papers presented at meetings and conferences. Of particular interest are sections (10) Administrative and Social, and (11) Bibliographies, Reference Works and Theses.

361. Air Pollution Publications: A Selected Bibliography with Abstracts, 1966-1968 (PHS Publication no. 979), Washington, U.S. Govt. Print. Off., 1969, 522 p.

A bibliography with abstracts of air pollution publications by National Air Pollution Control Administration personnel and personnel of organizations receiving federal air pollution funds has been released. Compiled by the Special Bibliographies Section of the Science and Technology Division of the Library of Congress, the bibliography contains over 1000 entries. It covers such aspects of the problem as the sources of air pollution and their control, effects of pollutants on man, fauna, flora, and materials, air quality standards, legal and social aspects, and basic science and technology.

362. American Association of University Women. A Resource Guide on Pollution Control; Federal, State and Local Agencies and Organizations that Deal with Environmental Problems. 2d ed. Washington, D.C. 1970, v.p.

This guide is an attempt to help the citizen gain an appreciation of what is being done in natural resources management by governmental and private organizations. Sources of information are indicated for air, water, noise and land use pollution abatement.

363. Bennet, Gary F. and James W. Hostman. A Bibliography of Books on the Environment — Air, Water and Solid Wastes. Toledo, Ohio, Research Foundation, University of Toledo, 1969, 52 p.

This bibliography, prepared for the Water Committee of the American Institute of Chemical Engineers, contains a list of books on technical and nontechnical control of air pollution.

364. Clean Air and Water News. Chicago, Commerce Clearing House. (Weekly)

This service features listings of new municipal, state, and federal air pollution laws and regulations, air quality control regions and a comprehensive coverage of developments in the field of air and water pollution.

365. Current Actions in Air Pollution. Washington, D.C., CPR Research. (Monthly.) 1971-

A private intelligence report on federal policy and administrative action for the control of air pollution. This report contains the most comprehensive and up-to-date information available on legislation past and pending, administrative organization of air pollution control agencies at the federal level, budget hearings, research and development, and the status of enforcement efforts. Current actions are analyzed, particularly with a view to possible future consequences.

366. Davenport, Sara J. Air Pollution; a Bibliography. (U.S. Bureau of Mines Bull. no. 537), Washington, U.S. Govt. Print. Off., 1954, 448 p.

This bibliography contains 3902 annotated entries from many sources arranged by subject. Covers nature and origin of air pollution, composition of air pollution, effects of air pollution, control, legal aspects, etc.

367. Environment Reporter. Washington, D.C., Bureau of National Affairs. (Weekly)

A loose-leaf comprehensive information service containing sections on federal and state air laws, current developments, and state and agency decisions in the field of environmental law.

368. Environmental Information ACCESS. New York, Ecology Forum, Inc. (Bi-weekly)

Information service in conservation and pollution published by Ecology Forum, Inc., New York (Suite 303 East, 200 Park Avenue, 10017) a nonprofit environment group. The service condenses and cross-references the environmental contents of more than 400 general, technical and scientific publications. The bi-weekly issues also abstract important corporate and conference publications, environmental books, films, radio and TV programs.

369. Flesher, Lorna. Pollution; a checklist of California State Agency Publications, 1960-1970. (GPS Publ. no. 6), Sacramento, California State Library, Government Publications Section, 1970, 21 p.

A checklist of selected California State Agency publications.

370. Guide to Research in Air Pollution. (Public Health Service Publ. no. 981), Washington, U.S. Govt. Print. Off., 1970.

List of projects active in the past calendar year, compiled by the Center for Air Environment Studies, Pennsylvania State University. It contains three parts: geographical, subject and principal investigator listing.

371. Knobbe, Mary L. Air Pollution: A Non-Technical Bibliography. (Exchange Bibliography no. 83), Monticello, Ill., Council of Planning Librarians, 1969, 9 p.

Briefly annotated bibliography giving general information on the subject and listing 70 items of interest to "local officials of your community."

372. Peckham, Brian W. Recent Literature on the Economics of Air Pollution. Raleigh, N.C., Division of Economic Effects Research, National Air Pollution Control Administration, October 1969.

This bibliography encloses major sources of information on the pollution and degradation of human environments. The 395 references are divided into sections covering periodicals dealing with air pollution and other problems of environmental management; bibliographies and other sources of information; and literature relating to benefit cost analysis and economic theory, air pollution economics, and problems of environmental management.

373. Public Health Engineering Abstracts. Washington, U.S. Public Health Service. (Monthly), 1928-

This journal contains 3000 abstracts a year of articles in more than 800 domestic and foreign journals, reports and proceedings of research groups, and government reports pertaining to environmental health.

374. Richardson, Marie S. "Bibliography on Air and Water Pollution." Special Libraries, vol. 57, no. 6, July-August 1966, pp. 385-390.

References are given in four sections: sources of information, including associations and organizations; books and reports; serial titles; and a selection of current articles.

375. Rydell, C. Peter and G. Schwarz. "Air Pollution and Urban Form: A Review of Current Literature." American Institute of Planners Journal, vol. 34, no. 2, March 1968, pp. 115-120.

This review of current literature, which includes a bibliography, shows that urban air pollution problems are caused not only by smokestacks and automobiles, but by the city structure. City forms can be planned to reduce the impact of air pollution rather than increase it.

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